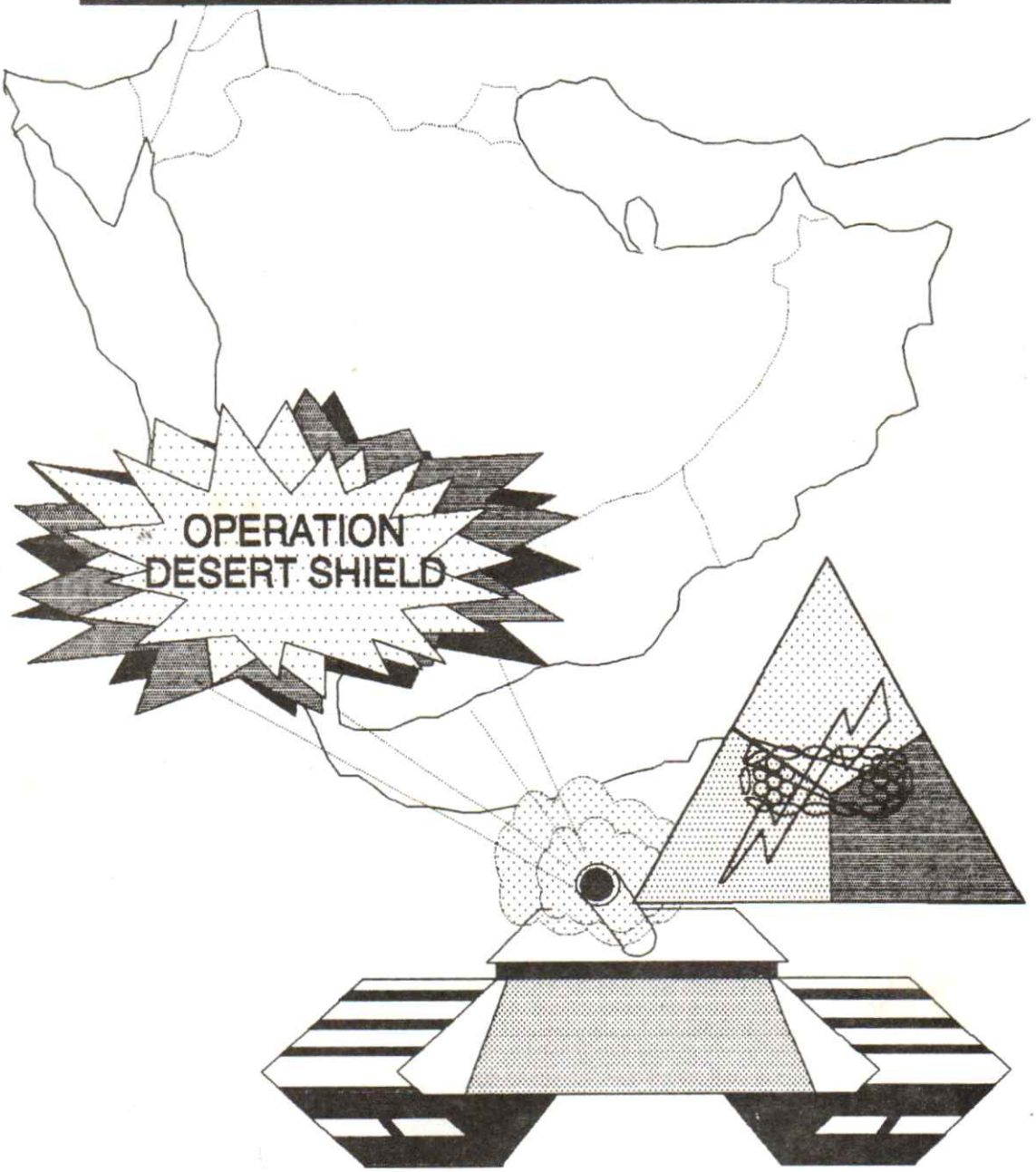
AUGUST 1990

U.S. ARMY ARMOR CENTER

TANKING IN THE DESERT



FORT KNOX, KY

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U.S. ARMY ARMOR CENTER
FORT KNOX, KENTUCKY

E R R A T A S H E E T

LESSONS LEARNED: DESERT OFFENSIVE OPERATIONS

EFFECTIVE DATE: 31 AUGUST 1990

IMPORTANT READ AND POST

ADMINISTRATIVE INSTRUCTIONS

Make the following changes:

Reference Page 7-39, Pen and ink the following change: Effectiveness of smoke in the desert is greatly reduced in the day time because of high temperatures and low humidity. Phosphorous smokes use water in the air to grow more dense. During the day, smoke is therefore much less effective than you are normally used to because there is less smoke and it rises rapidly. It is more effective at night if wind speeds are less than 5 mph. Dust caused by vehicle movement or artillery fire can be a very effective obscurant however.

IMPORTANT READ AND POST

FORWARD

The purpose of this pamphlet is to provide commanders with supplementary information about desert warfare and the current threat in Southwest Asia. It is not intended to replace current doctrine found in such manuals as FM 90-3, FM 71-1, FM 71-2, and FM 17-95. Our doctrine and tactics remain valid but we are continuing to learn new techniques which we have very quickly incorporated in this pamphlet. I realize it's not the final word and we'll be passing on more material as we find it.

FORGE THE THUNDERBOLT!

THOMAS C. FOLEY
Major General, U.S. Army
Commandant

28 AUGUST 1990

TANKING IN THE DESERT

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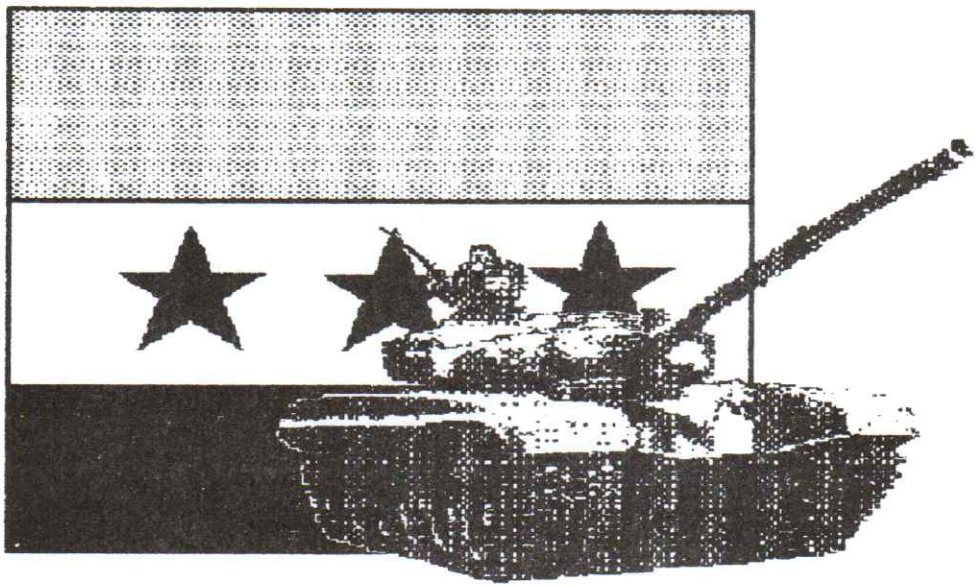
CHAPTER 1
AREA OF OPERATIONS



This chapter will cover the Desert Shield area of operations as it affects armor units and personnel. It does not include information contained in the Army Intelligence Agency booklet Identifying the Iraqi Threat and How They Fight. Some of the areas covered are:

- Weather and Terrain
- Regional Considerations
- Iraqi Equipment
- Iraqi Training
- Iraqi Chemical Threat *
- Iraqi Aviation **
- Iraqi Navy **

* For this subject, see the classified supplement also.
** These subjects are in the classified supplement only.

AREA OF OPERATIONS

I. Area of Operations

A. Weather and Terrain

1. Saudi Arabia

2. Kuwait

B. Saudi Arabia Forces

II. Iraqi Threat

A. Ground Forces

1. Equipment (Types/Numbers)/Organizational Rollup

2. Chemical (See also Classified Supplement)

3. Training

B. Air (See Classified Supplement)

C. Naval (See Classified Supplement)

SAUDI ARABIA WEATHER AND TERRAIN

The climate of the Arabian Peninsula is characterized by hot, dry summers and mild winters with little precipitation. Summer and winter, the two major seasons, are separated by short transition periods. Summers generally extend from June to September and winters from November to April.

Temperature: Mean daily temperatures in summer range above 104 degrees. Along the gulf coast the temperature is moderate and may remain in the 90 degree range, but in the interior of the country the temperature may reach in excess of 130 degrees. Mean daily temperature in the winter ranges from 32 to 54 degrees. Relative humidity in the summer ranges from 10 to 20 percent. Relative humidity in the winter ranges from 50 to 90 percent. The high temperature and low humidity in the summer in interior regions make for exceeding discomfort for nonacclimatized troops. In coastal regions, high humidity coupled with high temperatures also make for uncomfortable conditions. The low temperature and high humidity in the interior region during the winter make for very cold days and nights with near constant winds.

Northern Arabia: This area, due southeast of Jordan, is an upland plateau with a surface of dark colored rock and gravel. It is crossed by a number of wadis generally running northeast towards Iraq. It is covered by grass and scrub steppe vegetation.

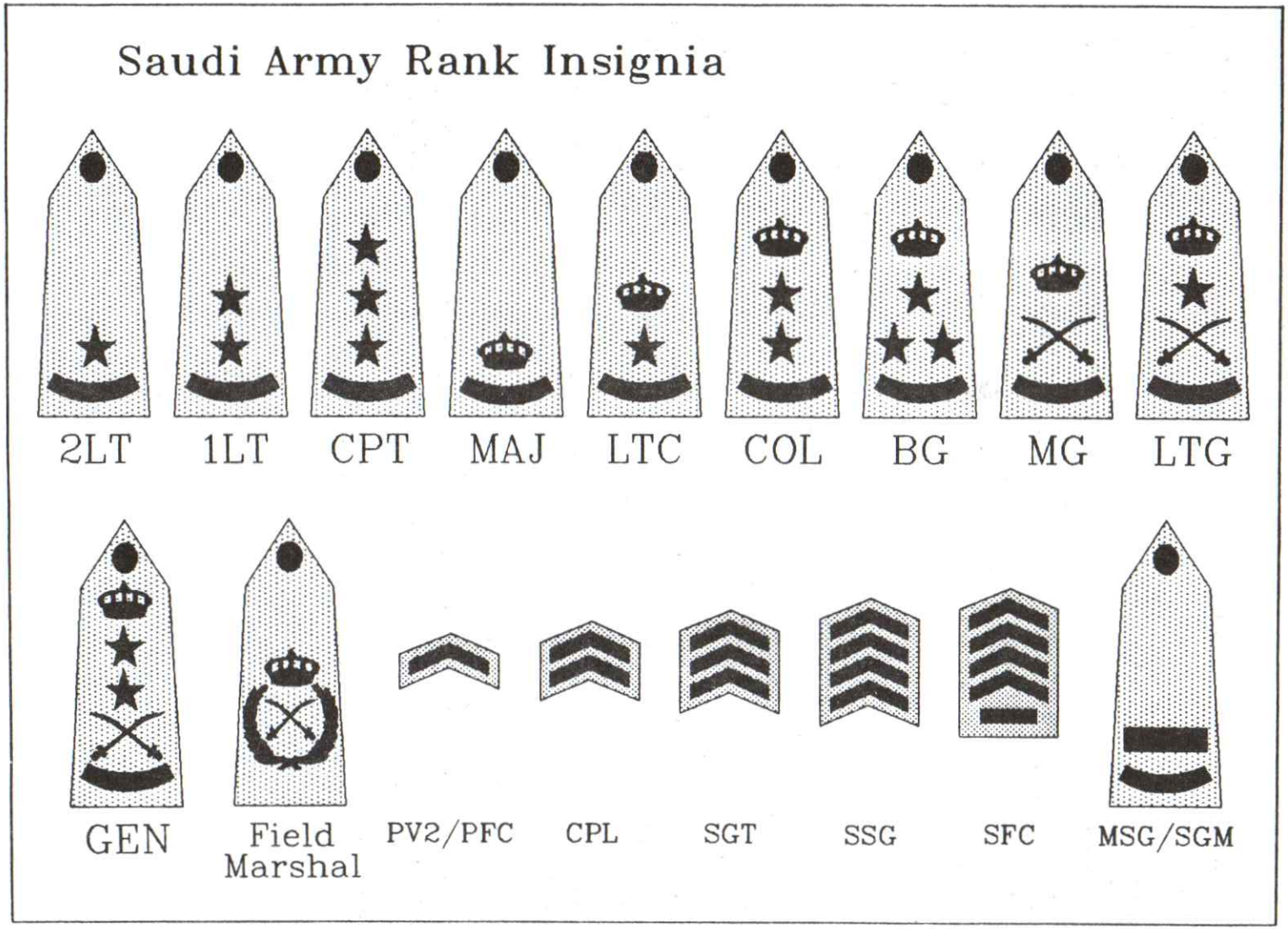
Rainfall in Saudi Arabia is minimal — usually less than 4 inches per year. What precipitation does occur, can be very unpredictable; it can be heavy and localized. The poor soil cannot always absorb sudden rainfalls, resulting in high runoff and possibly flash flooding in the wadis.

KUWAIT WEATHER AND TERRAIN

Kuwait has an arid climate. Summers are extremely hot, dry, almost cloudless, and maximum temperatures range from 72 to 120 degrees. Winters are mild with only moderate cloudiness and meager precipitation. Temperatures range from 30 to 108 degrees. The relative humidity near the coast ranges between 50 and 90%. The annual precipitation is less than 13 centimeters. Summer cloud cover generally averages below 10%. Cloud cover in winter ranges between 15 and 50%, with the majority occurring over the lowlands and foothills and isolated coastal areas. Visibility is generally best in winter and poorest in summer, with dust, blowing sand, haze, and fog causing the chief restrictions. Northerly surface winds predominate in winter and northwesterly winds in summer.

Except for the eastern coastal plain, Kuwait is a featureless desert rising 91 meters in the north to 274 meters in the south and falling gradually eastward to the Persian Gulf. The monotonous desert landscape is broken only by low rocky ridges or isolated hills. The Wadi al Batin, a well-marked and important depression, forms the boundary between Kuwait and Iraq. The northeastern portion of Kuwait's interior is an undulating gravel plain "dibdibba" with broad wadis, rocky ridges, small hills, and long, shallow depressions. The western portion of the dibdibba gradually rises from the northeast to the southwest with a sharp fall to Wadi al Batin in the west. Wadis and depressions trend southwest-northeast and are deeper than in the northeastern desert.

Sandstorms and duststorms are important climatic features of Kuwait. Visibility is greatly reduced at times, and the abrasive effects of sandstorms are not only discomforting to people, but detrimental to structures and exposed machinery. Wadis, streambeds that are normally dry, are numerous in Kuwait. With an exceptionally heavy rain, a wadi may be filled to overflowing in a very short time, producing a flash flood.


Saudi Army Rank Insignia
2LT
1LT
CPT
MAJ
LTC
COL
BG
MG
LTG
GEN
Field Marshal
PV2/PFC
CPL
SGT
SSG
SFC
MSG/SGM

EQUIPMENT/ORGANIZATIONAL ROLLUP

SAUDI ARABIA

MBT	550 Total	
	AMX-30	300
	M60A1 (to be A3)	50
	M60A3	200
APC	1,300 Total	
	M-113	1,100
	EE-11 Urutu	30
	Panhard M-3	170
RECON	AML-60/90	250
AIFV	AMP-10P	500+

TOWED ARTILLERY	168 Total	
105mm:	Model 56	24
	M101/102	40
155mm:	FH-70	70
	M-198	34
SP ARTILLERY	275 Total	
155mm:	M109	224
	GCT	51
MRL	127mm: ASTROS II	6

ATGM BGM-71A TOW (incl 200 VCC-1 SP), M-47 Dragon, HOT (incl AMC-10P SP)

TOTAL ARMED FORCES

Active: 65,700

Army:	38,000	
Navy:	7,200	(incl 1,200 Marines)
Air Force:	16,500	
ADA Forces:	4,000	

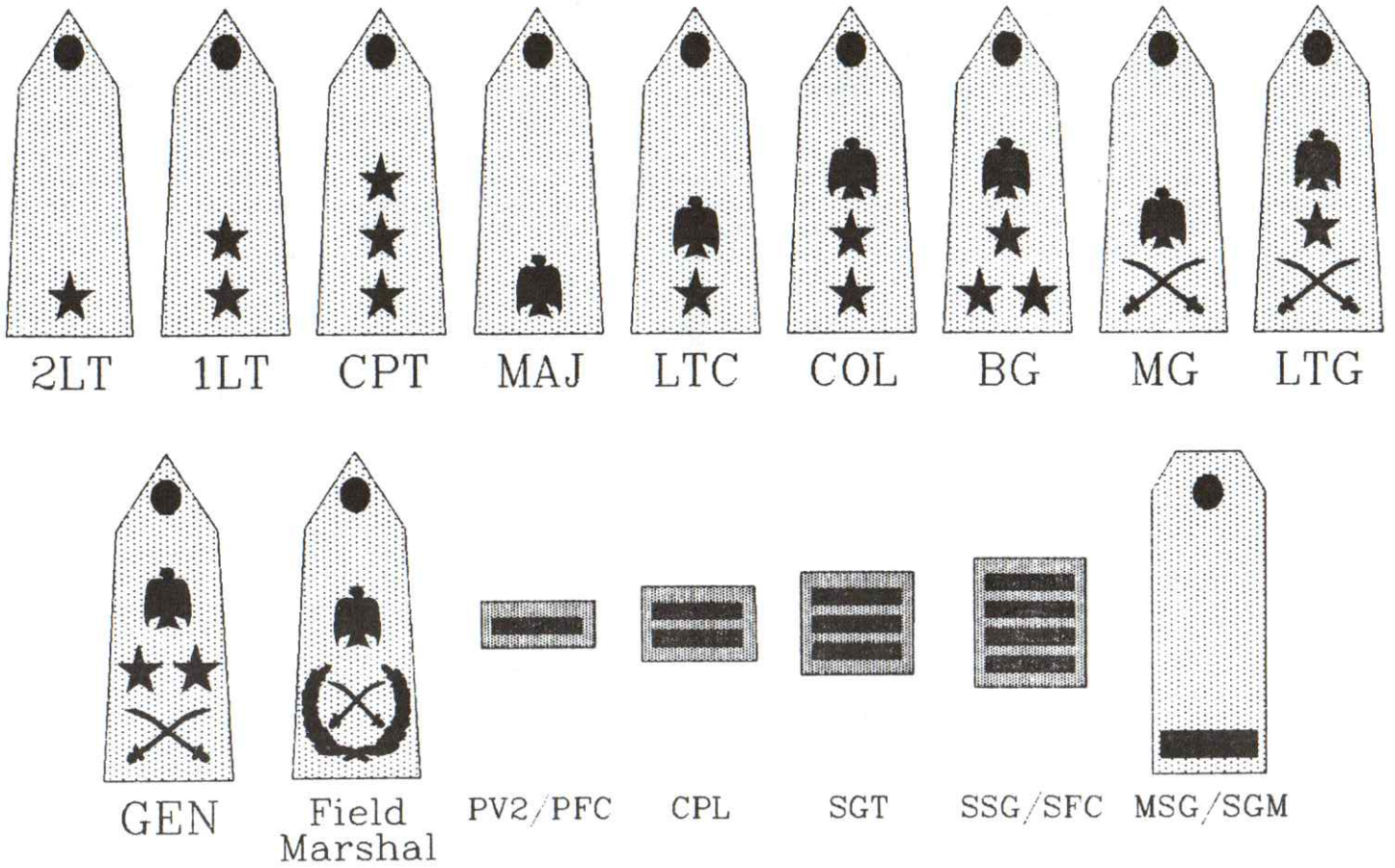
Terms of Service: Voluntary; conscription, males aged 18-35, authorized.

Army: 38,000

2 Armd Bde
4 Mech Bde
1 Inf Bde
1 AB Bde (2 AB Bn, 3 SF Co)
1 Royal Guard Regt (3 Bn)
5 Arty Bn
18 ADA Arty Bn

SOURCE: The Military Balance, 1989-1990
International Institute for Strategic Studies

Iraqi Army Rank Insignia



EQUIPMENT/ORGANIZATIONAL ROLLUP

IRAQ

MBT 5,530 Total

T-54/-55/M-77	2,500
CH Type-59/-69	1,500
T-62	1,000
Chieftain MK 3/5	30
M-60, M-47	
T-72	500

AIFV 1,000 Total

BMP	1,000

SP ARTILLERY 500 Total

122mm	2S1
152mm	2S3
155mm	M109
AVF-1 (GCT)	(85)

ATGM

AT-3 SAGGER (INCL BRDM-2)
AT-4 SPIGOT
SS-11 MILAN
HOT (incl 100 VC-TH)

APC 7,100 Total

BTR-50/-60-152
OT-62/-64
M-113A1, Panhard M-3
EE-11 Urutu

TOWED ARTILLERY: 3,000 Total

105mm M-56 pack
122mm D-74, D-30, M-1938
130mm M-46, Type 59-1
152mm M-1937, M-1943
155mm G-5 (100), GHN-45 (200), M-114

MRL 200 Total

122mm BM-21
127mm ASTROS II (60)
128mm ABABIL
132mm BM-13/-16
180mm ASTROS SS-40
300mm ASTROS SS-60

TOTAL ARMED FORCES

Active 1,000,000

Army:	955,000
Navy:	5,000
Air Force:	40,000

Terms of Service: 21-24 months

Army: 955,000

7 Corps HQ
7 Armd/Mech Div
42 Infantry Div
6 Presidential Guard Force Div (3 Armd/1 Inf, 1 Cdo Bde)
20+ SF Bde
2 SSM Bde

SOURCE: The Military Balance, 1989-1990
International Institute for Strategic Studies

IRAQ CHEMICAL CAPABILITIES

I. Delivery Systems - Chemically Capable

(U) A. 122mm Howitzer D-30
- Max Range - 15.3 km

(U) B. 122mm SP Howitzer - 2S1
- Max Range - 15.3 km

(U) C. 130mm Field Gun - M46
- Max Range - 27.5 km

(U) D. 152mm SP Howitzer - 2S3
- Max Range - 17.2 km

(U) E. 122mm Howitzer - M1938 (M-30)
- Max Range - 11.8 km

(U) F. 152mm Howitzer M1943 - D1
- Max Range - 12.4 km

(U) G. 122mm MRL - BM-21
- Max Range - 20.5 km

(U) H. 90mm Air To Ground Missile
- Max Range - 100 km

(U) I. Spray Devices - Usually Sprayed from HIP Helicopters

(U) J. Also disseminated by Cluster Bombs and Mines

(U) * Non-Persistent Nerve

Sarin
Tabun

- Symptoms - Difficulty breathing, drooling, nausea, vomiting, convulsions and dim vision.
- Effects - At low concentrations, incapacitates; kills if inhaled or absorbed through the skin.
- Rate of Action - Very rapid by inhalation, slower through the skin.
- How Disseminated - Aerosol or vapor.
- Protection Required - Protective overgarment and protective mask.
- Persistency in a Hot Climate - 2 hours to 12 hours.
- Decon - STB Slurry, household bleach, hot soapy water.

(U) * Persistent Nerve

VX (Possible) -

- Symptoms - Difficulty in breathing, sweating, drooling, nausea, vomiting, convulsions and dim vision.
- Effects - Incapacitates; kills if contaminated skin is not decontaminated rapidly.
- Rate of Action - Delayed through the skin, rapid through the eyes.
- How Disseminated - Liquid or droplets.
- Protection Required - Protective Mask and Protective Overgarment.
- Persistency in a Hot Climate - 4 to 12 days.
- Decon - STB Slurry, household bleach, hot soapy water.

(U) * Blister

Mustard

- Symptoms - no early symptoms.

- Effects - Blisters skin and respiratory tract. Can cause temporary blindness, some agents sting and form welts on skin.

- Rate of Action - Blister delayed hours to days; eye effects more rapidly.

- How Disseminated - Liquid or droplets.

- Protection Required - Protective Mask & Protective Overgarment.

- Persistency in a Hot Climate - Moderate 1-3 days Heavy 4-8 days

- Decon - STB, DS2, household bleach, hot soapy water.

(U) Decon Capabilities - One Chemical Company per Division. Limited information on configurations, most probably various configurations of decon, recon, and smoke.

(U) Decon Equipment - The Iraqis most probably use older Soviet decon equipment; rather than the newer jet decontamination equipment. They probably have the older water decon equipment.

(U) ARS-14 - Equipped with 1 2,500 liter tank to decontaminate vehicles, large weapon systems, heavy equipment and terrain. Can decon 50 tanks, 50 to 80 artillery pieces, or 500 meters of road 5 meters wide.

(U) DDP-2 - Trailer mounted decon unit. Has a steam chamber and boiler. Unit receives water from an external source.

(U) Individual Protection

Protective Suits

OP-1 - Soviet made, impermeable protection. Large, 1 piece coverall-type suit, to include hood. Set includes leggings and gloves.

L-1 - Soviet made, impermeable protection. Worn primarily by reconnaissance troops. Two-piece construction, trousers include boots, jacket includes hood.

Protective Masks

ShLEM - Iraqis most probably outfitted with old-style Soviet protective mask. Uncomfortable, difficulty breathing, no voice emitter, and no drinking tube.

Model K - Communications mask, includes voice emitter. Low visual efficiency.

TRAINING (U)

(U) Iraq has found it difficult to train soldiers in mastering all the different weapon systems in their arsenal.

(U) Training in basic soldiering skills was diluted drastically during the expansion of Iraqi forces towards the end of the war.

(U) Regular Army soldiers have been accustomed to fighting in the "static defense" mode.

(U) Republican Guard units are highly trained soldiers who were groomed to conduct the final offensive campaign against Iran.

(U) The war with Iran has trained many Iraqi officers in the management of the offensive battle.

CHAPTER 2

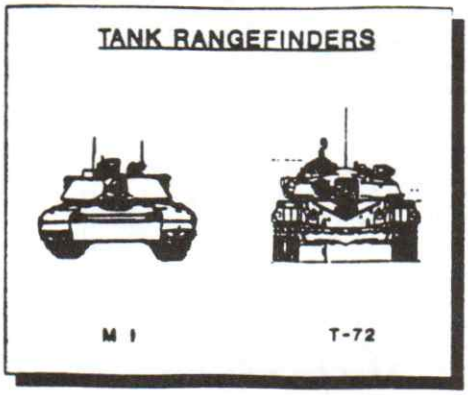
LASERS ON THE BATTLEFIELD

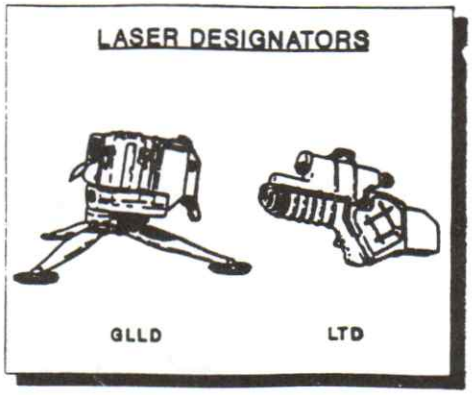
This chapter covers the following material:

- What can lasers do?
- Why are lasers dangerous?
- How do you defend against lasers?

LASERS ON THE BATTLEFIELD

- YOU WILL PROBABLY FACE TWO TYPES OF LASER SYSTEMS ON THE BATTLEFIELD





ALL OF THESE LASERS CAN INJURE YOU!!!

• TWO BASIC LASER HAZARDS EXIST: LASER RANGEFINDER AND LASER DESIGNATORS. OUR ARMY USES THESE SYSTEMS. (TANKS HAVE RANGEFINDERS; ARTILLERY FORWARD OBSERVERS USE TARGET DESIGNATORS). IRAQ USES THEM ALSO (THE T-72 HAS A LASER RANGEFINDER; IRAQI FORWARD OBSERVERS MAY HAVE RANGEFINDERS ALSO).

• THESE LASERS ARE NOT WEAPONS. BUT UNDER THE RIGHT CONDITIONS, THE LASER ENERGY PRODUCED BY ALL THESE SYSTEMS CAN INJURE UNPROTECTED SOLDIERS.

WHAT CAN LASERS DO?

- LASER RANGEFINDERS AND DESIGNATORS BOTH PRODUCE LASER PULSES.
- THESE LASER PULSES WILL:
  - TRAVEL IN STRAIGHT LINES ACROSS THE BATTLEFIELD.
  - MOVE AT 300,000,000 METERS PER SECOND.
  - PASS THROUGH THE LENSES OF MOST OPTICAL SYSTEMS.
    -- DAY/DIRECT VIEW SIGHTS.
    -- BINOCULARS.
    -- SUNGLASSES.
  - AFFECT YOUR VISION IF YOU AREN'T PROTECTED.
- THESE LASERS WILL NOT:
  - STUN, STERLIZE, OR VAPORIZE YOU.
  - PASS THROUGH ROCK, METAL, OR THICK SMOKE.
  - PASS THROUGH LENSES OF OUR THERMAL SIGHTS.
  - PASS THROUGH LASER FILTERS.

• **THE LASER HAZARD (FROM RANGEFINDERS AND DESIGNATORS) RESULTS FROM THE LASER PULSE'S ABILITY TO AFFECT YOUR EYESIGHT.**

• **EACH PULSE WILL:**

- TRAVEL IN STRAIGHT LINES UNTIL SOMETHING GETS IN THE WAY. LASERS ARE "DIRECT FIRE" SYSTEMS.

- MOVE AT THE SPEED OF LIGHT (300,000,000 M/S). EACH LASER PULSE WILL TRAVEL 100 KM BEFORE YOU CAN BLINK YOUR EYE.

- AFFECT MOST OPTICAL SYSTEMS. EACH LASER PULSE IS A BURST OF LIGHT THAT CAN PASS THROUGH DIRECT VIEW WEAPON SIGHTS, BINOCULARS, AND SUNGLASSES. (NOTE: SUNGLASSES WILL NOT STOP LASER PULSES.)

- IMPAIR YOUR VISION UNLESS YOU USE PROTECTIVE HARDWARE.

• **LASER PULSES WILL NOT:**

- STUN, STERILIZE OR VAPORIZE YOU. ONE THOUSAND LASER RANGEFINDERS, ALL FIRING AT ONCE, ARE NEEDED TO BURN A HOLE IN PLYWOOD.

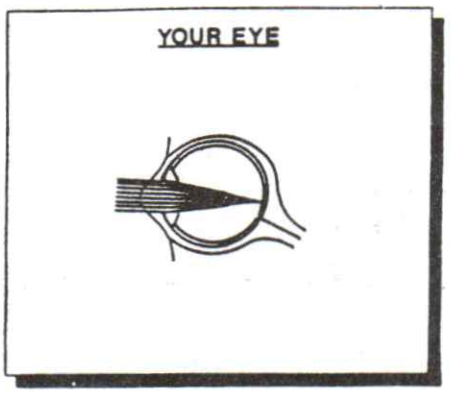
- PASS THROUGH ANYTHING THAT DISRUPTS OR INTERFERES WITH YOUR ABILITY TO SEE (SUCH AS THICK BATTLEFIELD SMOKE).

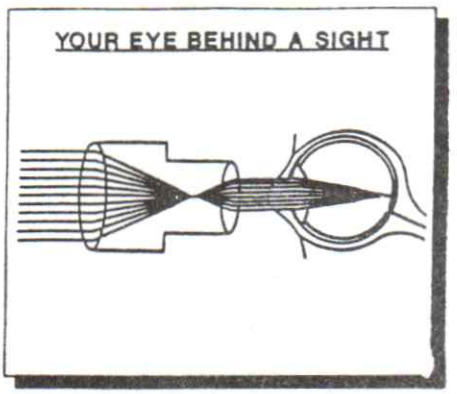
- PASS THROUGH THE LENSES OF THERMAL SIGHTS FOUND ON TANKS AND BFVS.

- PASS THROUGH THE FILTERS DESIGNED TO DEFEAT SPECIFIC KINDS OF LASER LIGHT.

WHY ARE LASERS DANGEROUS?

- LASERS PRODUCE AN INTENSE, FOCUSED BEAM OF LIGHT THAT IS MORE POWERFUL THAN THE BRIGHTEST SEARCHLIGHT.
- LASER LIGHT CAN BE VISIBLE OR INVISIBLE.
- LASER LIGHT CAN AND WILL AFFECT YOUR VISION.





• LASER ENERGY IS NOTHING MORE THAN AN INTENSE, HIGHLY FOCUSED BURST OF LIGHT. IT MAY BE VISIBLE OR INVISIBLE LIGHT. BOTH TYPES OF LASER LIGHT CAN AFFECT YOUR VISION.

• IF YOU ARE UNPROTECTED AND EXPOSED TO LASER ENERGY THE EFFECTS MAY BE:

- TEMPORARY BLURRING OF VISION.
- DAZZLE OR "FLASH BLINDING" LASTING FROM SECONDS TO MINUTES (FLASH BULB EFFECT).
- PERMANENT BLINDNESS (IF ENOUGH LASER ENERGY HITS YOUR EYE).

• THESE EFFECTS ARE DUE TO LASER ENERGY ENTERING YOUR EYE AND BEING FOCUSED ON YOUR RETINA. LOCATED AT THE BACK OF THE EYEBALL, THE RETINA CONTAINS NERVE ENDINGS THAT ENABLE YOU TO SEE.

• IF YOU ARE LOOKING THROUGH A MAGNIFYING OPTIC (SIGHT, BINOCULARS, ETC.) THAT DOESN'T HAVE A LASER FILTER, THE OPTIC'S MAGNIFICATION WILL CAUSE MORE LASER ENERGY TO GET INTO YOUR EYE. THEREFORE, YOU CAN SUFFER MORE SERIOUS INJURY. THE GREATER THE MAGNIFICATION, THE MORE SUSCEPTIBLE YOU ARE TO LASER INJURY.

HOW DO YOU DEFEND AGAINST LASERS?

- USE PROTECTIVE HARDWARE:
  - BALLISTIC LASER PROTECTIVE SPECTACLES (BLPS) (2 AND 3 LINE FILTERS).
  - LASER-FILTERED SIGHTS IN TANKS AND BRADLEYS.
- TRAIN TO MINIMIZE EFFECTS OF LASER ATTACK.
  - USE THERMAL SIGHTS AS MUCH AS POSSIBLE.
  - MINIMIZE USE OF DIRECT VIEW, MAGNIFYING OPTICS.
    -- DAYLIGHT CHANNELS ON GUNNER'S SIGHTS.
    -- BINOCULARS.
  - USE LOWEST MAGNIFICATION POSSIBLE.
  - SCAN BATTLEFIELD -- DON'T STARE!!!
  - TREAT ALL LASERS AS POTENTIAL WEAPONS.
- USE PROPER TACTICS.
  - USE SMOKE TO COVER/OBSCURE BATTLEFIELD.
  - USE COVER AND CONCEALMENT.
  - SUPPRESS WITH DIRECT/INDIRECT FIRE.

• **PROTECTIVE EQUIPMENT IS AVAILABLE:**

- BLPS ARE NOT SUNGLASSES; THEY ARE DESIGNED TO PROTECT YOU FROM LASER RANGEFINDERS AND DESIGNATORS.
- MOST WEAPONS SIGHTS ARE ALREADY PROTECTED AGAINST MOST LASER HAZARDS.

• TRAIN TO PROTECT YOURSELF. TO DAMAGE OR IMPAIR YOUR VISION, LASER ENERGY MUST GET INTO YOUR EYE. THEREFORE:

- USE THERMAL SIGHTS. LASER ENERGY FROM RANGEFINDERS AND DESIGNATORS WILL NOT PASS THROUGH THE OUTER LENSES OF OUR THERMALS.
- DON'T USE DIRECT VIEW, MAGNIFYING OPTICS, UNLESS YOU HAVE TO; USE THE LOWEST MAGNIFICATION POSSIBLE WHEN YOU USE THESE OPTICS.
- DON'T STARE AT ANY ONE SPOT ON THE BATTLEFIELD FOR TOO LONG; USE SCANNING TECHNIQUES.
- TREAT ALL LASERS AS POTENTIAL WEAPONS.

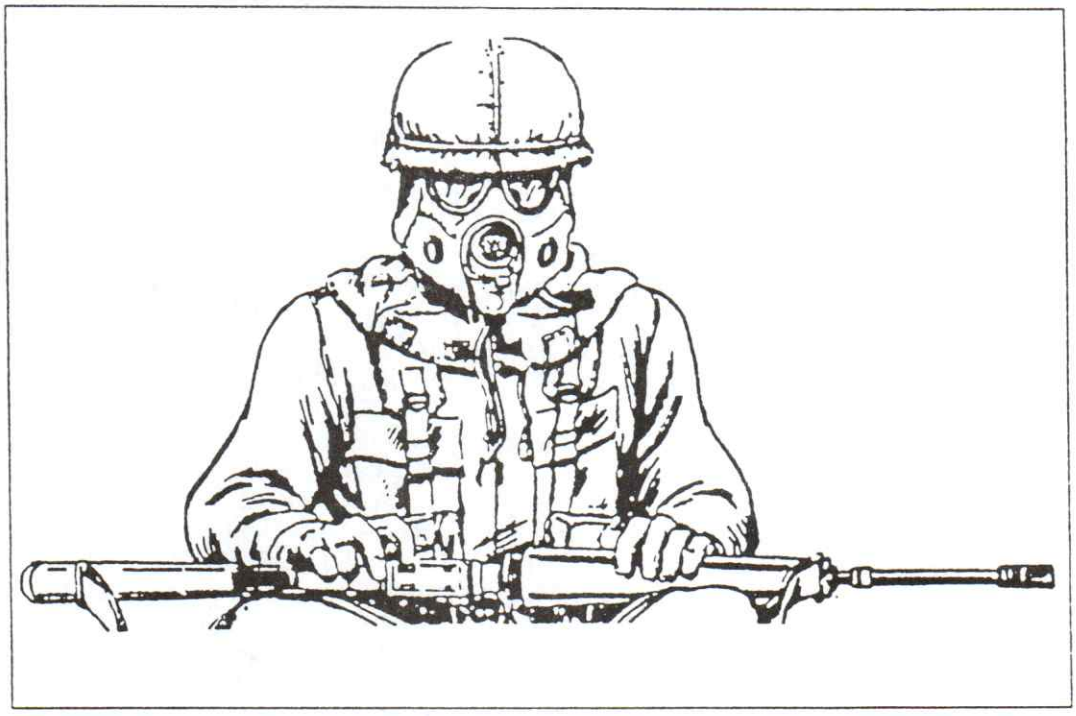
• PROPER TACTICS WILL ALSO REDUCE THE LASER HAZARD:

- USE SMOKE TO DEGRADE LASER CAPABILITIES.
- COVER AND CONCEALMENT OR ANYTHING ELSE YOU PUT BETWEEN YOU AND THE LASER WILL PROTECT YOU FROM LASER PULSES (LASERS ARE DIRECT FIRE SYSTEMS).
- SUPPRESS KNOWN OR SUSPECTED LASER POSTIIONS WITH DIRECT OR INDIRECT FIRE.

LASERS ARE PRECISION-MADE INSTRUMENTS THAT CONTAIN MANY OPTICAL COMPONENTS.

CHAPTER 3

CHEMICAL WARFARE IMPLICATIONS



This chapter will cover the chemical warfare implications that will confront the Armor soldiers in the desert environment. It will cover the following areas:

- Contamination avoidance
  - Chemical warning and reporting
  - Chemical detection
  - Chemical defensive preparations
- Decontamination
- Desert operations

CONTAMINATION AVOIDANCE

CHEMICAL WARNING AND REPORTING

- IDENTIFYING CONTAMINATED AREAS (GRID REFERENCE) WILL BE EXTREMELY DIFFICULT.
- MARK CONTAMINATED AREAS TO SIX AND EIGHT DIGITS WHENEVER POSSIBLE; AREAS MARKED WITH ONLY FOUR DIGITS MAY BE IMPOSSIBLE TO FIND.
- CONTAMINATED AREA OVERLAYS IN A DESERT ENVIRONMENT WILL NEED CONSTANT UPDATING.
- AGENTS WILL TRAVEL RAPIDLY OVER SPARSELY VEGETATED OPEN AREAS.
- UNITS SPREAD OVER WIDE AREAS WILL HAVE TO USE RADIO COMMUNICATIONS TO WARN ELEMENTS.
- KEEP WARNING DEVICES DISTINCT, I.E. GONGS, SIRENS, FLARES.
- KEEP REPORTS SIMPLE; ONLY SEND ESSENTIAL DATA REQUIRED TO SPEED WARNING DISSEMINATION. FOLLOW UP WITH ADDITIONAL INFORMATION AS REQUIRED. USE JINTACCS MESSAGE FORMAT WHENEVER POSSIBLE.

Due to undefined terrain features, identifying and plotting contaminated areas will be difficult and also require commanders to constantly update operation boards as contaminated areas clear rapidly. Information will be essential to elements required to leave and return to unit, i.e. mess, supply, and maintenance. Recommendation: due to envisioned short contamination persistency, artillery smoke could be used to confirm grid locations and colored smoke used to mark contaminated areas until clear. If not, barrels filled with sand or sand bags to support markers may be required.

Keep warning and reporting methods "clear and distinct"; pre-positioned gongs, makeshift sirens, or aerial flares can be used effectively. Avoid commonplace warning (horns or metal; on metal) example: Supply sergeant coming in late at night setting up camouflage net (metal on metal) causes unit to mask and go to MOPP 4.

All soldiers should have on their person a copy GTA 3-6-3 NBC Warning and Reporting System, and be familiar with drafting messages. Commands must know communication capabilities of subordinate elements and vice versa in order to develop and expedite chemical warning traffic. Have available preprinted chemical message forms and header sheet to speed the process.

Do not hinder subordinate units not in the predicted hazard zone by sending "blanket messages." Example: Company A is under a chemical attack and gives the command "GAS" on the Squadron net, when based on wind direction only Alfa and Bravo Company were threatened. Develop and refine specific reporting procedures.

CONTAMINATION AVOIDANCE

CHEMICAL DETECTION

- MUSTARD/BLISTER AGENT WILL BE DIFFICULT TO DETECT; NO STAND-OFF DETECTION WILL BE AVAILABLE. IF FOX CHEMICAL RECON VEHICLE IS AVAILABLE, USE FOR STAND-OFF DETECTION AND ADVANCED PARTY ESCORT.
- M8A1 CHEMICAL AGENT DETECTOR ONLY DETECTS NERVE AGENTS.
- CAM CAN BE USED FOR POINT DETECTION OF BLISTER/ NERVE AGENTS.
- M8A1 ONLY TO BE USED OUTSIDE VEHICLE DUE TO RADIOACTIVE SOURCE; NO INTEGRAL VEHICLE POWER SOURCE OUTSIDE OF TANK TO SUPPORT DETECTOR.
- WD-1 MUST BE RUN FROM DETECTOR UNIT OUTSIDE TO THE ALARM UNIT INSIDE THE TANK THROUGH THE MILES OR COMMUNICATION OPENINGS. ENSURE PASSAGE WAYS ARE RESEALED.
- TERRAIN MAY DICTATE MORE DETECTORS OVER WIDER FRONTS.

The inability of the M8A1 to detect other than nerve agents poses a tremendous threat to our forces. This problem is compounded by the slow response times associated with the M256 Kit and the "point only" capabilities of the Chemical Agent Monitor (CAM). Driven by the dictates of our equipment, recommend commanders implement an automatic masking policy when faced with unknown smoke or when observing artillery or bomblets. The key to overcoming these limited capabilities is flexibility. Chemical operations in the desert are a two edged sword (heat casualties versus protection levels). Personnel must identify threats and assume increased MOPP postures rapidly. At the same time commanders must be sensitive to heat casualties caused by prolonged periods in MOPP. They must confirm the contamination in a timely fashion and adjust or eliminate MOPP levels appropriately.

Use the CAM for in-tank monitoring and point detection as well as affirming the presence or absence of chemical agents. The CAM will give the commander a much quicker assessment of agent type and level. However, if time permits use the M256 as a back-up. Issue of CAM should be one per tank.

Wide fronts and greater dispersion of unit elements should be used to increase survivability. Rapidly shifting winds will require units to requisition greater numbers of Detectors and Alarm Units. Specific guidance can be found in FM 3-3.

CONTAMINATION AVOIDANCE

CHEMICAL DETECTION

- ENVIRONMENT AND LACK OF VEHICLE POWER FOR M8A1 WILL DICTATE HIGHER USE RATES FOR DETECTOR BATTERIES AND FILTERS.
- COMMON BATTLEFIELD INTERFERENCE WILL CAUSE FALSE ALARMS AND THE M8A1 CANNOT DIFFERENTIATE BETWEEN MUNITIONS FUMES AND LETHAL AGENTS.
- CHEMICAL PAPERS M8/M9 ARE FOOLED BY PETROLEUM PRODUCTS. ALSO, AVOID ABRADING PAPER; THIS WILL CAUSE FALSE COLOR CHANGE.
- THE M256 DETECTION KIT IS SLOW IN RESPONSE TIME (10 MINUTES PLUS).

Plan for the requisition of larger numbers of batteries and filter elements for detectors and alarm units. Specific guidance can be obtained in TM 3-6665-312-12&P; pay special attention to the Operation Under Unusual Conditions Section.

Chemical Paper M9 placed on vehicles so that it is visible through vision blocks is also a good way of assessing the presence or absence of liquid chemical agents before exiting the vehicle. Caution: use of the red lens flashlight at night does not provide the capability to check chemical paper for red or brownish spots (signs of contamination). The spots are not visible with this mode of filtered light.

CONTAMINATION AVOIDANCE

CHEMICAL DEFENSIVE PREPARATIONS

- NEVER ALLOW SOLDIERS TO LEAVE THEIR IMMEDIATE WORK AREA WITHOUT CARRYING INDIVIDUAL CHEMICAL PROTECTIVE EQUIPMENT.
- CARRY ALL ESSENTIAL ITEMS (SUCH AS SOI, WRIST WATCH, AND GREASE PENCILS) IN ONE PLASTIC BAG IN CASE OF CHEMICAL ATTACK. ONCE IN MOPP 4 IT IS DANGEROUS TO RETRIEVE THESE ITEMS.
- NEVER CONSOLIDATE CHEMICAL STOCKS; ONE COMPLETE SET SHOULD BE WITH THE SOLDIER'S EQUIPMENT, ANOTHER SET STORED ON HIS VEHICLE.
- DISPERSED UNITS WILL SUFFER FEWER CASUALTIES FROM DIRECT CHEMICAL ATTACKS.
- DEVELOP STANDARD MOPP LEVELS TO ENHANCE THE UNIT SURVIVABILITY POSTURE.
- USE "MASK ONLY" POSTURE WHENEVER MINIMUM CHANCE OF EXPOSURE TO PERSISTENT AGENTS IS EXPECTED. DOCTRINALLY, ARMOR UNITS EMPLOYED FORWARD WILL ONLY BE EXPOSED TO NONPERSISTENT AGENTS.
- MOBILITY ADDS TO THE EQUATION OF SURVIVABILITY; ARMOR IS MOBILE, THUS LESS LIKELY TO FALL PREY TO DIRECT CHEMICAL ATTACKS.
- STANDARD COVERING OF SUPPLIES AND EQUIPMENT WILL GREATLY REDUCE CONTAMINATION/SPREADING AND SUBSEQUENT RECON ACTIVITIES.
- CHECK SEALS ON WATER BUFFALO'S AND FIVE GALLON CANS; THESE OFTEN LEAK AND ARE EASILY CONTAMINATED. KEEP CANTEENS FULL; ONCE IN MOPP THERE IS NO WAY TO REFILL.

Basic rules apply for chemical preparation as outlined in FM 3-3.

The implementation of standard MOPP postures will provide a change in individual performance and survivability. Recommend during day time operations, when chemicals will be least effective, a level of MOPP Ø or 1. Increase this level to MOPP 2 or 3 in the evenings as it becomes cooler and the likelihood of attack/effects becomes greater. A Standard MOPP level also allows for faster upgrading of posture.

DECONTAMINATION

- DUE TO "ONBOARD STORAGE OF WATER" REQUIREMENTS FOR DECON, SPECIFIC VEHICLES MAY HAVE TO BE EAR MARKED AS WATER BLADDERS/SENATOR CARRIERS.
- ARMOR UNITS WILL REQUIRE ADDITIONAL DECONTAMINATION ASSETS.
- WATER AND SECURED AREAS REQUIRED FOR DECONTAMINATION SITES WILL BE AT A PREMIUM.
- DECON SITES WILL BE DIFFICULT TO MARK AND BURYING EXPENDED MOPP EQUIPMENT MAY BE IMPOSSIBLE DUE TO SHIFTING SANDS.
- PERFORM PRE-OPERATIONS ON THE M11 DECON APPARATUS; EFFECTIVENESS OF OLDER DS-2 STOCKS QUESTIONABLE.

Additional decon resources will be required by Armor Units to conduct Hasty/Deliberate decon. This problem exists primarily due to space constraints and safety problems associated with carrying large amounts of DS-2 onboard. To fill this void Armor Units at a minimum, should add an additional M13 Decon Apparatus to each Resupply/Rearm vehicle. Additionally vehicles initially planned for resupply/rearm may have to become carriers for water and decon assets.

Earth is a better decontaminant than water. Sand can be used to remove the majority of liquid agent, thus saving valuable water supplies. Lack of overhead cover and terrain features will make units particularly vulnerable to attack during decontamination procedures; recommend decon operations be conducted in pockets (smallest elements possible) and dispersed over wide areas.

Marking and burying at decontamination sites will be difficult if not impossible. Shifting sands would simply uproot markers or quickly uncover buried waste thus reintroducing a vapor threat. If wind direction is favorable, recommend burning contaminated articles as an alternative. If not, saturation of garments with slurry prior to disposal would be a safe alternative.

M11's have a high tendency to become plugged or the spring nozzle release to be rusted shut. Recommend pre-operations checks discharging either water or alcohol to determine status. In addition older stocks of DS-2 may have become ineffective over time, due to weathering, leakage, etc. Recommend filling M11's from existing M13 Decon Apparatus.

DECONTAMINATION

- EXPECT PERSISTENCY OF CHEMICAL AGENTS TO BE OF SHORTER DURATION THAN SHOWN IN STANDARDS CHARTS, I.E. HOURS FOR PERSISTENT AGENTS, MINUTES FOR NONPERSISTENT AGENTS.
- ENSURE VEHICLE AS WELL AS CHEMICAL PROTECTIVE FILTERS ARE CHANGED AFTER A CHEMICAL ATTACK/ATTACKS.
- DECONTAMINATION OF VEHICLE INTERIOR IS DIFFICULT DUE TO WIRING, OPTICS, AND ELECTRONICS SENSITIVITY.
- REQUISITION OF LARGE NUMBERS OF PERSONAL DECON KITS, DS-2, AND STB FOR RECONSTITUTION SHOULD BEGIN IMMEDIATELY.

Avoid contaminating the inside of vehicles as much as possible. Interior decon is difficult and corrosive properties associated with decon solutions are often damaging to wiring, optics, commo gear, etc. If vehicle is contaminated, follow NBC Entry and Exit Procedures and avoid exiting as much as possible. Your Chemical Agent Monitor (CAM) is great for a "quick sniff" to determine contamination inside and outside the tank. If it is determined that the vehicle interior is contaminated, the Personal Decon Kit or the Decontamination Kit Individual Equipment (DKIE) is great for small interior contamination. For gross interior contamination, recommend spraying using the M11 Apparatus with a solution of bleach and water. If bleach is not available a light solution of STB and water could be used. FM 3-5 provides a break down of available decontaminants and their uses.

Requisition early (pre-stock) and requisition as soon after attacks as possible. Decontamination Operations are labor and resource intensive. Well trained leaders and knowledgeable soldiers will speed and ease decon operations. Know your people and know their sizes; requisition wisely; pay special attention to smaller items sometimes overlooked, i.e. inlet valve assemblies, head harnesses, eye lens outserts, drinking hose assemblies, canister hoses (M25), vehicle and NBC filters, etc. Follow guidance in FM 3-5 to determine quantities of decontaminants required.

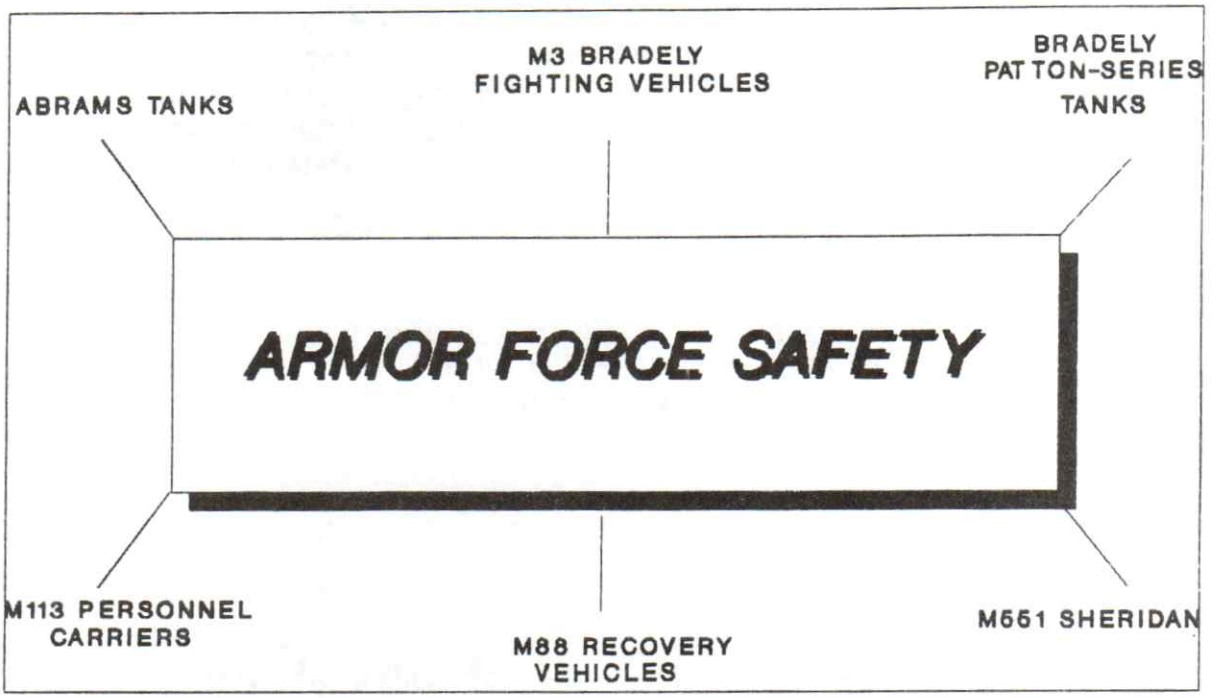
CHEMICAL PROTECTION

DESERT OPERATIONS

- DAYTIME WEATHER CONDITIONS ARE NOT FAVORABLE TO CHEMICAL ATTACKS.
- NIGHTFALL AND EARLY MORNING ARE ADVANTAGEOUS TO CHEMICAL ATTACKS AND MUST BE CONSIDERED IN ALL PLANNING OF DESERT OPERATIONS.
- EXPECT SPOT OR ON-TARGET CHEMICAL ATTACKS.
- USE COLLECTIVE PROTECTION CAPABILITIES AS MUCH AS POSSIBLE TO RELIEVE THE EFFECTS OF HEAT AND MOPP.
- EXPECT AN INCREASE OF THREE TO FIVE GALLONS OF WATER PER MAN IN MOPP 3/4.
- SOLDIERS MUST WEAR BDU'S UNDER MOPP GEAR. PERSPIRATION WILL DEGRADE OVERGARMENT EFFECTIVENESS.
- AT NIGHT MAINTAIN HIGH GROUND IF POSSIBLE. AGENTS WILL LINGER AND SETTLE IN LOW AREAS. CONVERSELY, AGENTS WILL RISE RAPIDLY IN THE HEAT OF DAYLIGHT HOURS.
- PERFORM STRENUOUS TASKS AT NIGHT AND DEVELOP AN EFFECTIVE WORK/REST SCHEDULE AMONG CREWS.
- PLAN OPERATIONS WITH THE WEAKEST LINK IN MIND; BRADLEY FIGHTING VEHICLE CREWS WILL SUFFER MORE DEGRADATION IN A CHEMICAL ENVIRONMENT THAN ABRAMS CREWS WITH COLLECTIVE PROTECTION. USE DEGRADATION TABLE IN FM 3-4 FOR PLANNING.

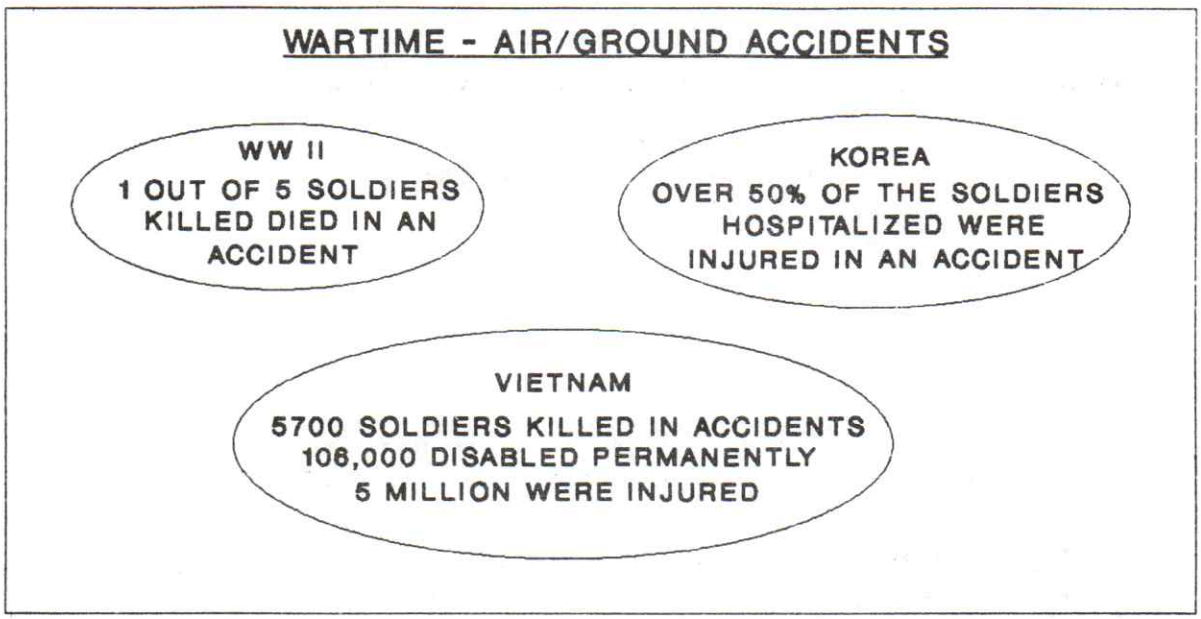
Desert Operations will present a number of challenges to unit leaders. Degradation can be kept to a minimum by utilizing collective protection capabilities as much as possible and by wisely implementing MOPP and work/rest cycles. Expect and plan for increased water consumption and high use rates of chemical overgarments. Do not degrade soldiers unnecessarily, i.e. soldiers with collective protection systems or in shelters do not require the same protection levels as ground troops. The Armor force has at its disposal the best equipment possible for a chemical conflict and will be exposed less than any soldier on the battlefield. Be flexible and use these tools to your advantage.

CHAPTER 4
SAFETY



This chapter will cover the safety implications that will impact Armor personnel operating in the desert environment. It will cover information that is not found in other sources, or information that is vital and needs to be highlighted. Some of the areas covered are:

- Safety with lasers.
- Safety with halon.
- Desert operations.
- Common accidents.
- Vehicle fires.
- Safety with ammunition.
- Recovery in the desert.
- Accident prevention.


WARTIME - AIR/GROUND ACCIDENTS
WW II
1 OUT OF 5 SOLDIERS KILLED DIED IN AN ACCIDENT
KOREA
OVER 50% OF THE SOLDIERS HOSPITALIZED WERE INJURED IN AN ACCIDENT
VIETNAM
5700 SOLDIERS KILLED IN ACCIDENTS
106,000 DISABLED PERMANENTLY
5 MILLION WERE INJURED

- One of the devastating forces opposing U.S. forces during a war is the increased number of accidents.

- Wartime accidents prove to be extremely costly to warfighting resources.

- These accidents are preventable and their number and severity can be predicted and minimized.

- The key to prevention is:

  - Careful upfront planning.
  - Communication and coordination.
  - Awareness of personnel and resources.

SINGLE GREATEST CAUSE OF ALL ACCIDENT LOSSES
IS
HUMAN ERROR

MAJOR REASONS FOR HUMAN ERROR

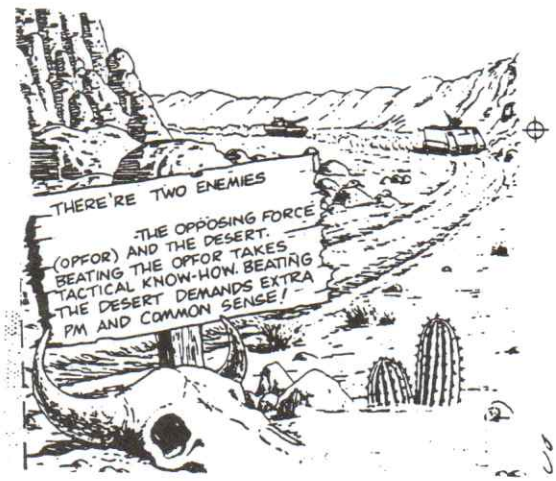
- STANDARDS ARE NOT CLEAR OR PRACTICAL OR DO NOT EXIST
- STANDARDS EXIST BUT ARE NOT KNOWN
- STANDARDS ARE KNOWN BUT ARE NOT ENFORCED
- STANDARDS ARE KNOWN BUT ARE NOT FOLLOWED

Accident losses can be avoided by the commander's direct intervention into the mission operations with:

RISK MANAGEMENT

Risk management can uncover accidents and their severity by identifying high risk areas, tasks, and operations before the soldiers uncover these hazards with the loss of life and/or equipment.

UNIQUE SAFETY PROBLEMS FOR DESERT ENVIRONMENTS


THERE'RE TWO ENEMIES
-THE OPPOSING FORCE (OPFOR) AND THE DESERT.
BEATING THE OPFOR TAKES TACTICAL KNOW-HOW. BEATING THE DESERT DEMANDS EXTRA PM AND COMMON SENSE!

- Watch storage and disposal of food. Snakes and spiders as well as scorpions are drawn to it.
- Be careful of jacking up vehicles in sandy areas; ensure that all vehicles carry some type of jacking foundation (plywood, concrete block/step, etc.).
- Be aware of free roaming camels; they are very difficult to move and will cause catastrophic damage to vehicles and soldiers.
- Be careful of cooling electric equipment with wet rags/towels and other materials You may get electrocuted or damage equipment.
- Be aware of traveling on sand dunes with heavy vehicles the sand may give way and cause vehicle rollovers.
- August through November temperatures range from 85 to 125 degrees Fahrenheit. DRINK PLENTY OF FLUIDS!
- Commanders watch for the signs of heatstroke and heat exhaustion.

ABRAMS/ARMOR VEHICLE FIRES

- IN A GENERAL SENSE, VEHICLE FIRES COULD PROVE TO BE THE GREATEST CAUSE OF VEHICLE DOWNTIME.

- ALL CREWMEN AND MAINTENANCE PERSONNEL MUST BE AWARE OF THE WARNING SIGNS FOR FIRE HAZARDS.

- DESERT OPERATIONS INCREASE THE PROBABILITY FOR FIRE

  - DIRT AND SAND CLOG FILTERS.
  - AMMUNITION MAY NOT FUNCTION PROPERLY.
  - VEHICLE ENGINES RUN HOTTER.
  - TRACK PADS AND TIRES WEAR OUT FASTER.
  - FIRE-FIGHTING EQUIPMENT FUNCTIONS DIFFERENTLY.

- USE THE ABRAMS FIRE PREVENTION BOOKLET SERIES PUT OUT JOINTLY BY U.S. ARMY ARMOR SCHOOL AND PM ABRAMS. INCLUDED IS A LAMINATED POCKET CHECKLIST FOR HIGH RISK FIRE HAZARDS.

- DESERT HEAT WILL INCREASE THE PROBABILITY FOR FUEL AND HYDRAULIC LEAKS.

- THE COOLING TURBINE (NBC TUBE AXIAL FAN ASSEMBLY) MUST BE FUNCTIONING PROPERLY. MALFUNCTIONS WITH THE ASSEMBLY WILL CAUSE HOT AIR TO BE PULLED INTO THE NBC FILTERS AND CREATE A MAJOR FIRE HAZARD.

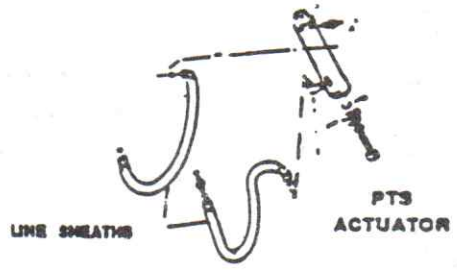
- BOTTOMLINE -- BE WATCHFUL FOR FIRE HAZARDS IN THE THE ENGINE AREAS OF ALL VEHICLES.

ABRAMS/ARMOR VEHICLE FIRES

POWER TURBINE STATOR (PTS)

Power Turbine Stator (PTS) Actuator

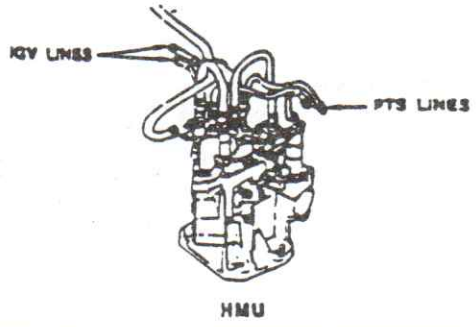
- Check for leaks at the PTS actuator lines, connections, and actuator body. Feel to make sure all fittings are tight and lines are not damaged, soaked, or crimped.
- Make sure the line sheaths completely cover the hose (up to the fittings).



HYDRO-MECHANICAL UNIT (HMU)

Hydro-Mechanical Unit (HMU)

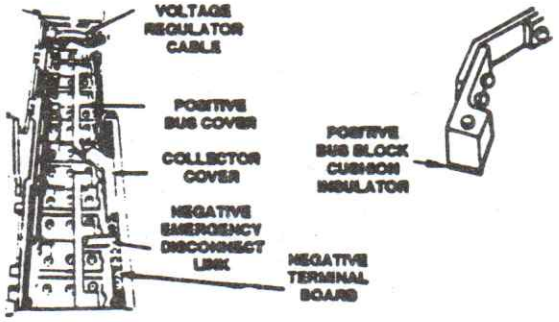
- Check the HMU, lines, and fittings for any signs of leakage.
- Look at top of AGB for fuel/oil accumulation.



BATTERY BOX AREAS

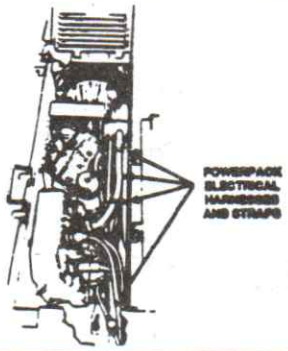
Visually inspect Battery Box for signs of damage and remove any noticible debris. Pay particular attention to the following:

- Check the positive bus and collector covers for signs of melting.
- Check that the voltage regulator and cable are not damaged.
- Check the negative emergency disconnect link and terminal board for damage.
- Inspect the bottom of the positive bus block carefully to make sure the cushion insulator is not missing or damaged.



ABRAMS/ARMOR VEHICLE FIRES

ELECTRICAL WIRING HARNESSES



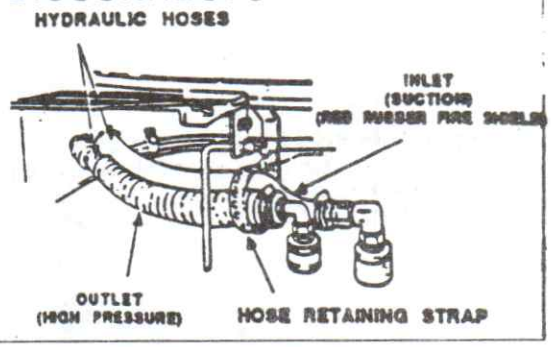
Do not disconnect connectors during the following inspection:

- Feel to make sure all connections are tight and all insulators are in place.
- Ensure quick disconnect panel is clean and free of debris.
- Check harnesses for cuts, chafing, arcing, or signs of damage.

HYDRAULIC QUICK DISCONNECTS

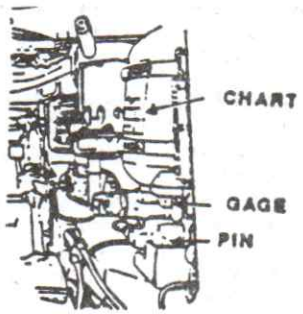
Hydraulics

- Check the hydraulic pump, hoses, and fittings (QD's) for tightness and leaks.
- Check that the hydraulic hose fire shields are in place (properly clamped and entirely covers the inlet and outlet lines) and undamaged.
- Check that the hydraulic hose retaining strap is in place and the hoses are properly secured.



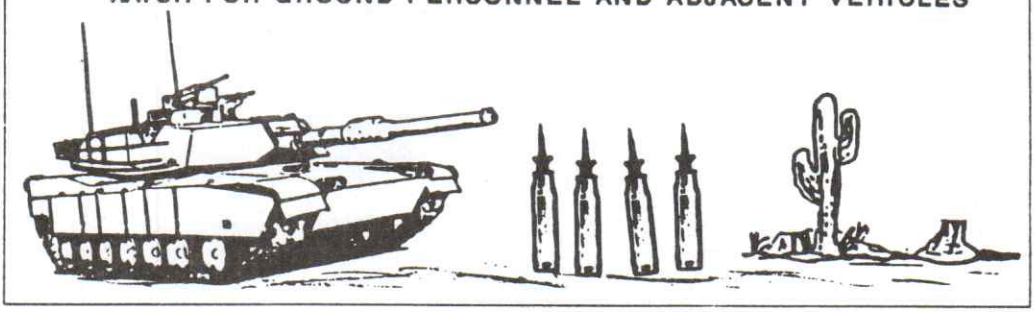
FIRE BOTTLES/SENSORS

- Make sure the three halon valve and bottle assemblies are charged and safety pins are removed.
- Check the four fire sensor lenses for damage and ensure connections are tight.
- Inspect the cables and connectors and ensure they are not damaged.
- Ensure the two (2) portable fire extinguishers are present and accessible.
- Clean the lens with a clean cloth.



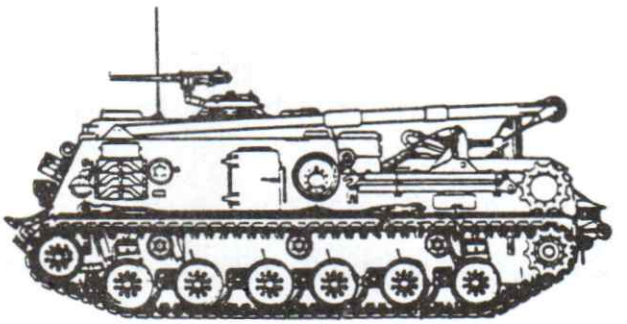
CAUTIONS PERTAINING TO 120-mm AMMUNITION

- BE AWARE OF THE POSSIBILITY OF AMMUNITION "FLAREBACKS" WITH OR WITHOUT HALON DISCHARGES
- BE AWARE IMPULSE NOISE HAZARDS ABOVE AND AROUND FIRING ARMOR VEHICLES
- WATCH FOR GROUND PERSONNEL AND ADJACENT VEHICLES



Commanders will need to warn soldiers of the posaible hazards related to 120-mm ammunition. There may be instances when the fired maingun round will produce a "flare back" when the breech opens to expel the stub base. The serious hazard associated with these occurrances is the possibility of the turret fire suppression system discharging in a hostile environemnt. The soldiers must also be sure that they know their options once the fire suppression system does discharge; and the fact that they will no longer have automatic fire suppresson capabilities until the bottles are recharged. Soldiers must also be warned of the high impulse noise hazards created by a fired large ammunition round. There are many ways to reduce the hazards of high impulse noise, such as getting behind barriers, covering your ears, and reducing the number of exposures. In the desert it will be harder for soldiers to find and take cover behind barriers. It would be the responsibility of commanders to warn other soldiers (from other countries or branches of service) of the high impulse noise hazards associated with ammunition.

RECOVERY AND TOWING OPERATIONS



- CRITICAL ELEMENT OF COMPLETING ANY MISSION IS THE ABILITY TO RECOVER DAMAGED ARMORED EQUIPMENT.
- THE SAND WILL MAKE THESE OPERATIONS WORSE AND INCREASE THE WEIGHT OF THE VEHICLE BEING RECOVERED OR TOWED

Whenever possible ensure that the following safety guidelines are followed:

- When you tow an M1 or M1A1 tank, take extreme care with the hookup, speed, turning, and stopping.
- The tanks weigh more than the M88 and that creates safety problems.

  - Always use a third vehicle as a hold-back vehicle when you tow an M1 or M1A1 even though you use a tow bar.
  - Allow no one to ride in or on the vehicle being towed.
  - Tow at speeds of 5 mph or slower with tow bars, and at 2 mph or slower when using cables.

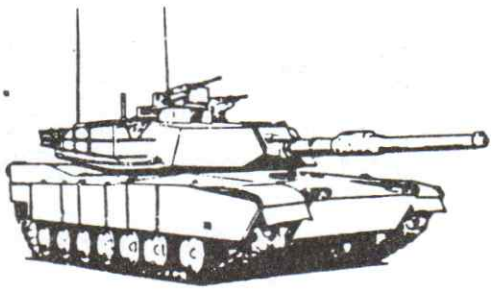
The tank being towed may push the "88" sideways and run up the rear of the vehicle, ruin the vehicle's transmission/brakes, or flip it over.

COMMON ABRAMS ACCIDENTS

- VEHICLE COLLISIONS.

  ——→ REDUCED VISIBLITY, EXCESSIVE SPEEDS, & COMMUNICATIONS.

- AMMUNITION DOOR ACCIDENTS.
- TURRET ROTATIONS.
- FALLS FROM AND INSIDE OF TANKS.
- HATCHES FALLING ON SOLDIERS.



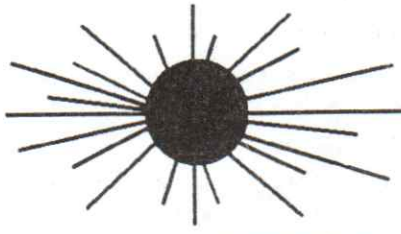
Abrams crewmen will have to be alerted to the fact that most of the common Abarms vehicle accidents will increase in number because of desert operations. The most frequently occurring accident is vehicle collisions. This category will increase because of reduced visibility and track traction. Soldiers will need to increase travel distance and reduce vehicle speeds. Ammunition door accidents may increase as will turret rotation injuries. The dirt and sand may cause the door and/or turret to malfunction resulting in injury. The proper operating procedures must be stressed at all times. Slips and falls will become more common also. The soldier will be under more stress and be thinking of other tasks which may cause additional accidents and injuries. Each common accident can be predicted and guarded against by stressing standards of operation and cordinating each and every movement in, on, and around the vehicle. There will also be soldiers who are not familiar with the armored vehicle and they must be watched and warned of hazardous situations.

SAFETY MEASURES REGARDING HALON

- ENSURE THAT THE FIRE SUPPRESSION SENSORS ARE CLEAN AND UNOBSRUCTED.
- HALON SUPPLIES MAY BE LIMITED FROM HOST NATION BUT CONUS WILL SUPPLY WHATEVER IS NEEDED.
- HALON SYSTEMS ARE SUPPRESSENTS NOT EXTINGUISHERS, SO BE PREPARED TO USE HAND HELD EXTINGUISHERS TO COMPLETELY PUT OUT THE FIRE.
- THERE ARE TIME RESTRICTIONS THAT ONE MUST FOLLOW FOR EVACUATING AN ENCLOSED AREA IN WHICH HALON HAS FLOODED -- BE AWARE THAT THERE ARE DANGERS OUTSIDE THE VEHICLE AS WELL (ENEMY FIRE, NBC, ETC.)
- EXCESSIVE HEAT MAY CAUSE THE HALON TO DISCHARGE ACCIDENTALLY.

SAFETY MEASURES WITH LASER OPERATIONS

- BE AWARE OF DIFFUSE REFLECTION HAZARDS OFF OF THE SAND AND MATERIAL ON THE SAND.
- SCRATCHES ON THE LENSES WILL OCCUR DURING SAND STORMS -- NOT A HAZARD TO THE LASER PROTECTION.
- WATCH FOR FRIENDLY FORCES AND LASER DISCHARGES.



LASER SAFETY

GUARDING AGAINST FRATRICIDE

- IN HOT CLIMATES THE SURROUNDING AREA WILL MOST LIKELY BE HOTTER THAN YOUR TARGETS.
- TAKE PRECAUTIONARY ACTION IN IDENTIFYING AND ENGAGING THE ENEMY TARGETS.

Soldiers will have to be careful when identifying and firing at targets on the battlefield. This fact will even be more critical in the desert environmnet because of the hot surrounding objects and the unfamiliar terrain and backgrounds.

This facet of the battlefield will increase the necessity of enforcing standards of operation, utilizing techniques of risk management, and flawless communication and soldier coordination.

KEY FACTORS FOR ACCIDENT PREVENTION

- COMMUNICATION AND COORDINATION.
- ALERTNESS OF PERSONNEL.
- RISK MANAGEMENT BEFORE OPERATIONS.
- PREPARATION.

The facts pointed out in these pages concerning Armor Force safety are stressed throughout each soldier's armor career. They are highlighted here to allow commanders to focus on each and every safety hazard for corrective actions and hazard elimination. The battlefield is a hazard in itself and will take its own toll on war resources; therefore, commanders must be able to impact those hazards that can be controlled --- namely accidents. Past history has very clearly demonstrated the effects that accidents have on the equipment and soldier's operational effectiveness.

These guidlelines are not intended to cover all aspects of the battlefield or all safety and health hazards confronting the soldier. They are not to be used in lieu of operator's manuals either. The key aspects spelled out here are the elements of accident prevention:

- Communicate and Coordinate.
- Using risk management techniques.
- Prepare.
- Be alert of surroundings.

DESERT OPERATIONS REFERENCES

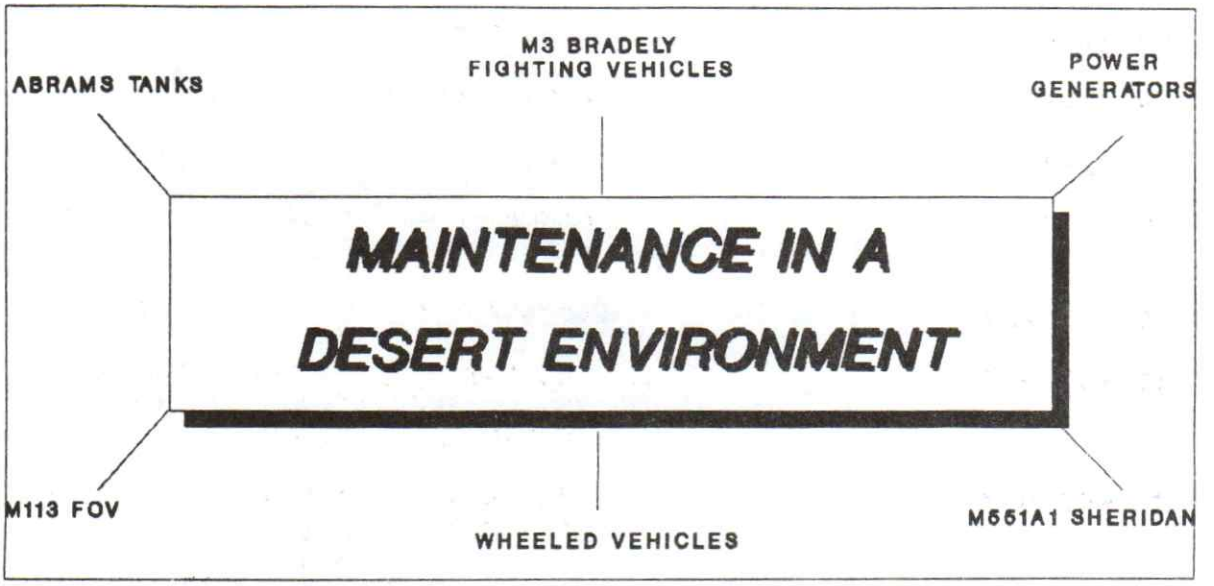
FM 10-52	FIELD WATER SUPPLY
FM 10-52-1	COMMANDER'S HANDBOOK FOR WATER USAGE IN DESERT OPERATIONS
FM 21-10	FIELD HYGIENE AND SANITATION
FM 21-10-1	UNIT FIELD SANITATION TEAM
FM 21-11	FIRST AID FOR SOLDIERS
FM 21-76	SURVIVAL
FM 90-3	DESERT OPERATIONS
TB 43-0239	MAINTENANCE IN THE DESERT
TB MED 507	OCCUPATIONAL AND ENVIRONMENTAL HEALTH PREVENTION, TREATMENT, AND CONTROL OF HEAT INJURY
TB MED 577	SANITARY CONTROL AND SURVEILLANCE OF FIELD WATER SUPPLIES
GTA 8-5-45	HEAT INJURY PREVENTION AND FIRST AID (POCKET CARD)

* EQUIPMENT TECHNICAL MANUALS AND LUBRICATION ORDERS LIST SPECIAL OPERATING REQUIREMENTS AND SERVICES FOR DESERT/HOT WEATHER CONDITIONS.

TRAINING FILM: TUT 20-6340 (72040-DA); WATER AND SURVIVAL; DIARY OF THREE SOLDIERS.

CHAPTER 5

MAINTENANCE



This chapter contains specific maintenance tips and lessons learned for desert operations. Some of the areas covered are:

- Fuel filters.
- Vee Packs.
- Het tires.
- POL.
- PLL.
- Halon fire extinguishers.
- Radiators.
- Batteries.
- Radios.
- Track.

MAINTENANCE

MAINTENANCE IN A DESERT ENVIRONMENT

Temperatures range from 80-125 degrees Fahrenheit

- **Radios get too hot.**
- **Batteries do not hold charge.**
- **Need proper POL.**
- **Fire extinguishers overheat.**

RADIOS may also overheat. Wet rags placed on top of them will help keep them cool and operational. Do not cover vents. Low power setting will reduce heat buildup.

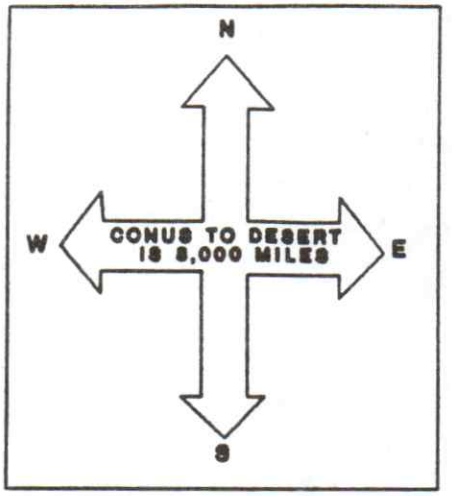
BATTERIES do not hold their charge efficiently in intense heat. Check them twice daily. Keep them full. Be sure to use distilled water. Tap water in the desert may contain chemicals that will weaken the battery's acid solution. Battery specific gravity will have to be changed to adjust to the desert environment. TM 9-6140-100-12 contains procedures for adjusting the battery's specific gravity. Be sure to clean the battery cap vents daily. Plugged vents cause gases to build up that can cause the battery to explode in the heat of the desert. A paper clip makes a good battery vent cleaning tool. Keep battery terminals clean and free of grease. Grease collects dust and sand. Don't forget to order plenty of dry batteries to offset high attrition rates caused by heat exposure.

POL PRODUCTS must fit the temperatures. See your Lube Order for specifics.

HALON fire extinguishers must be treated with care. High desert temperatures may cause them to discharge spontaneously. Put wet rags on them during the hottest part of the day to help cool them.

MAINTENANCE

MAINTENANCE IN A DESERT ENVIRONMENT cont



HET TIRES

FUEL FILTERS

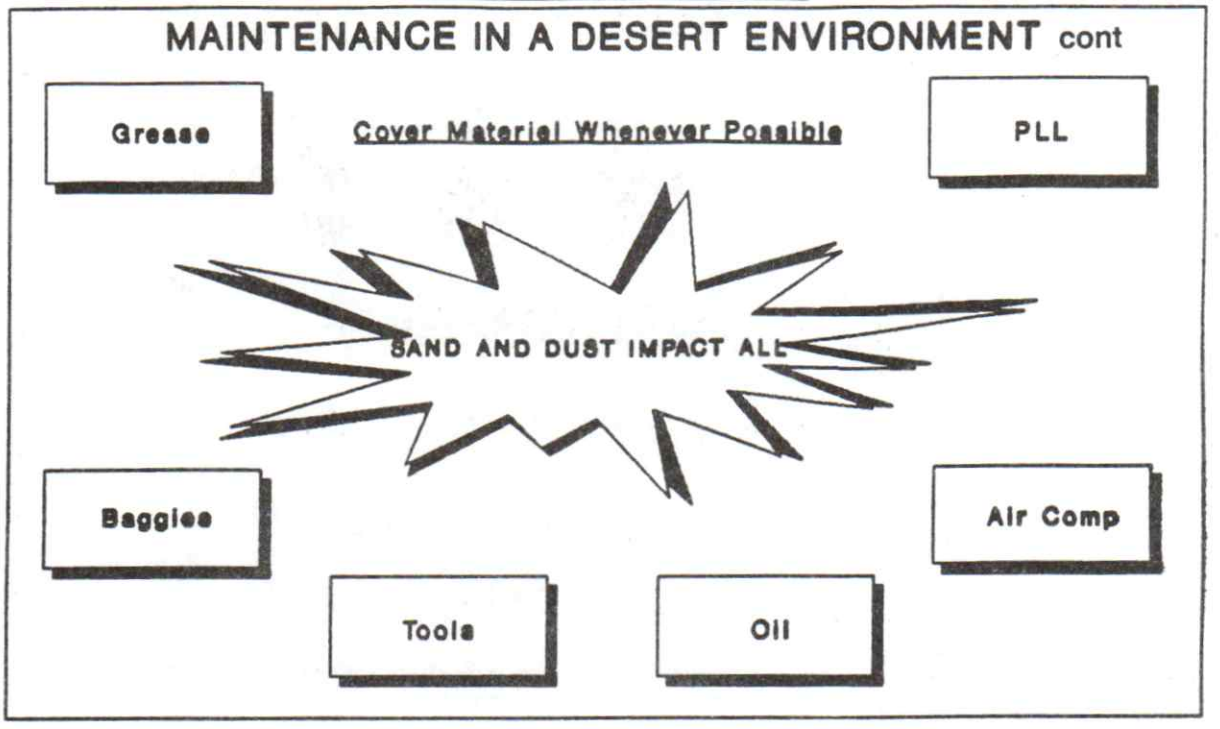
- **Long supply line.**

SUPPLY LINES are long - up to 8,000 miles. Try to predict Class III and IX requirements and submit requisitions early. Proper diagnoses of components become very important to ensure that misdiagnosed/good LRUs are not passed back needlessly.

HOST NATION HET "BALLOON" TIRES will not hold up when transporting Abrams tanks. These "sand" tires, designed for transporting lighter loads cross-country, must be replaced with US type HET tires before transporting these tanks. Approximately 16 ply should work OK.

FUEL FILTERS need to be checked often. Fuel filter use will be high; take or order extras. Contaminated fuel and dirty fuel containers are more likely in this environment. In addition, local, higher detergent fuels may be used which may clean deposits from fuel lines, and clog fuel filters quickly during the first couple of weeks. Water contamination is also a problem when days are hot and nights are cold. Fuel in vehicles that have been on ships for several days or weeks may have severe water contamination problems. Follow the procedures outlined in your -10 TM when servicing your fuel filters.

MAINTENANCE



SAND AND DUST are everywhere. Keep all components covered whenever possible. Local fabrication of covers should be considered.

GREASE AND OIL collect dust and sand. After cleaning, wipe excess oil and grease off all exposed surfaces and components.

BAGGIES, cloth, or plastic must be used to protect open or disassembled components from blowing sand and dust. The same goes for disconnected water, oil, or other fluid lines. Be sure to cover both ends of the connection.

ALL POL dispensing tools must be stored in protected areas to prevent contamination, i.e., grease gun ends covered, 90W pump bracket hose covered, oil dispensing nozzles covered.

ALL PLL items must be stored to prevent contamination, i.e., oil and air filters covered with plastic wrap and , fuel filters, hoses, and other components/parts as necessary.

AIR COMPRESSORS are essential for cleaning air filters and removing dust and sand from components. Be sure to clean the intake air filter daily. As a general rule, use no more than 30 PSI when cleaning air filters on all equipment. Check your -10 TM just to be sure.

MAINTENANCE IN A DESERT ENVIRONMENT cont

MAINTENANCE TIPS

- **Tarp Under Equipment Being Repaired.**
- **Lubrication is Best Without Sand.**
- **Radiator T.L.C.**

PLACE A PIECE OF TARP or other material under the equipment or component being worked on to ensure dropped tools or small components are not lost in the sand. This also keeps them cleaner.

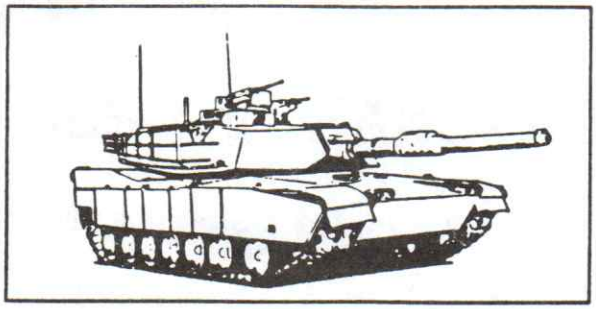
RADIATORS require extra attention. Be sure to use distilled water since tap water may contain chemicals that form a crusty coating inside the radiator and clog it. A mix of 40% antifreeze and 60% water is usually the correct mix, but you should check your -10 TM just to be sure. Inspect radiator fins daily, and be sure to blow out sand and dust from the radiator fins at least weekly. Conditions may dictate that this be done more often. Park tactical vehicles with rear facing the wind to keep sand out of the radiator.

PROPER LUBRICATION is essential. Wipe off grease fittings before you plug in the grease gun and after you are finished. Keep cans of grease covered so sand will not blow into the grease. Use of grease cartridges in lieu of bulk grease is recommended. Be sure to load your grease gun in a protected location to prevent sand from getting inside the grease gun.

MAINTENANCE

MAINTENANCE IN A DESERT ENVIRONMENT cont

Abrams Tank



- **Heat and Horsepower.**
- **Tracks, Speed, and Heat.**

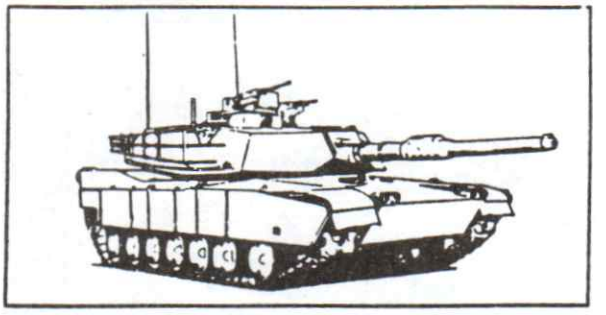
GROSS HORSEPOWER is reduced as temperatures rise. With the NBC overpressure system off, horsepower remains constant at 1500 until the temperature exceeds 88 degrees Fahrenheit. It then drops as the temperature rises. At 130 degrees Fahrenheit, it is reduced to 1200. Use of the NBC overpressure system further reduces horsepower. With the NBC overpressure system on, horsepower remains constant at 1475 until the temperature exceeds 76 degrees F. At 130 degrees F, it is reduced to 1000.

TRACKS require extra care. Grit, heat, and bad track tension put you down in no time. Sprockets wear out quickly in sandy conditions. Track pins seem to break more easily in high heat. High temperature also increases rubber-metal separation on roadwheels. Proper tension is critical. Loose track is easily thrown in soft sand. T-156 track wears out quickly when run on hardtop highways in high temperatures. The rubber chunks from the track. Past experience has shown this may occur in as little as 100 km at speeds in excess of 30 MPH on hot days in Saudi Arabia. Running on the sand will alleviate this problem but will cause greater wear on the metal components. COMMANDERS - PLAN YOUR MOVEMENTS TO PERMIT SLOWER SPEEDS AND/OR TRAVEL DURING THE COOLER PERIODS OF THE DAY AND AT NIGHT. Use T-158 track as soon as it is available. It is much more durable. A different socket(1-1/8 inch, 6 point, 3/4 drive) is required for the T-158 end connectors. (5130-00-227-6681)

MAINTENANCE

MAINTENANCE IN A DESERT ENVIRONMENT cont

Abrams Tank



- **Vee-Packs.**
- **Fuel Filters.**
- **NBC Heat Exchanger.**

VEE-PACKS will require more frequent cleaning. Experience in Saudi Arabia has shown that cleaning is required every 250 km or 6-10 operating hours, whichever occurs first. Operating during sandstorms may require more frequent cleaning. Power loss is an indicator that Vee-Packs need to be cleaned. Note: DO NOT CONFUSE THIS WITH POWER LOSS CAUSED BY OPERATING IN HIGH TEMPERATURES. Clean Vee-Pack with compressed air, 30 PSI or less. Do not use your own bleed air wand to clean your own Vee Packs. You can redue cleaning requirements by keeping the engine turned off as much as possible. If the situation permits, get your crew off the vehicle and shut it down. If subjected to an NBC attack, remember to change (NOT CLEAN) your Vee-Packs WHILE YOU ARE STILL IN MOPP GEAR. The filters will remain contaminated until you discard them.

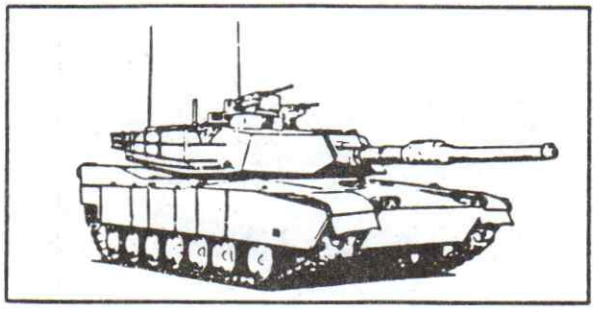
FUEL FILTERS may get clogged if you are issued contaminated fuel and/or use dirty fuel containers. Water contamination may also be a problem due to the hot/cold cycles in the desert. Pay particular attention to this when you get ready to take your vehicle off the ship. Keeping the fuel tanks full will reduce water condensation, thereby reducing water contamination.

THE NBC HEAT EXCHANGER clogs easily in desert conditions. Remember, it is on whenever you use the microclimatic cooling system. The heat exchanger is not very accessible and cleaning is time consuming. Use it as little as the tactical situation permits.

MAINTENANCE

MAINTENANCE IN A DESERT ENVIRONMENT cont

Abrams Tank



- **Dry Surfaces.**
- **Baggies.**
- **Tank Tarp.**
- **Class IX.**
- **Cover Components.**

KEEP OIL AND GREASE wiped off exposed surfaces. This includes gun tubes, grenade launcher tubes, and battery terminals. Grease and oil collect dust and sand.

KEEP PLASTIC BAGS handy to cover all disconnected fuel, water, and oil lines. Be sure to cover both ends of the connection.

USE COVERS on all exposed components whenever possible to keep dust and dirt off. Local fabrication of covers may be required. Abrams RPSTLs provide NSNs for all dust caps/covers needed to protect connectors, lines, etc. Also, ensure all test jacks are capped.

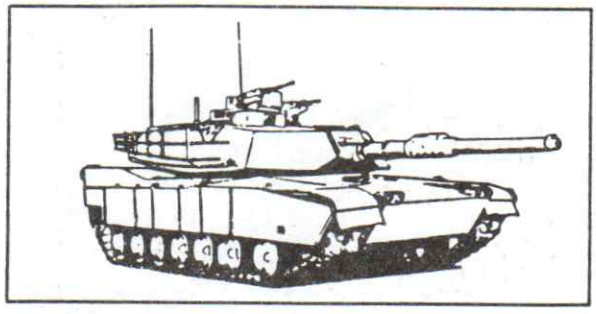
THE TANK TARP can keep dust and heat down. Use it whenever the situation permits. Keep hatches closed as much as possible to keep dust from entering crew compartments. Clean dust from crew compartments daily.

CLASS IX resupply will take longer. The "pipeline" is about 8000 miles long. This makes it essential to do good diagnostics. Your STE-M1 will probably not work in the high heat. Alternate Troubleshooting Procedures (ATP) will most likely be the norm. Be sure to double-check "bad" parts by "Swing Testing" them. Your Unit Level Logistics System (ULLS) may not work in the heat. Be sure your PLL clerks and supply clerks are prepared to submit manual requisitions.

MAINTENANCE

MAINTENANCE IN A DESERT ENVIRONMENT cont

Abrams Tank



- **Cannibalization / BDAR.**
- **Halon.** • **Batteries.** • **Radios.**
- **Road Wheel Hubs.**

COMMANDERS must establish cannibalization and BDAR SOPs and enforce them. Don't get into a "wartime mentality" or your OR rates will plummet.

HALON fire extinguishers in the crew compartment may discharge spontaneously in the high heat, especially in the afternoon. Keep them cool by placing wet rags on them.

BATTERIES should be checked twice daily. Keep them full. Add distilled water. Local tap water could contain chemicals that will weaken the battery's acid solution. Battery specific gravity will have to be changed to adjust to the desert environment. See TM 9-6140-100-12 for these procedures. Keep the battery cap vents open. A paper clip makes a good tool. The battery could explode if these vents become clogged. Keep battery terminals clean and free of grease. Grease collects dust and sand.

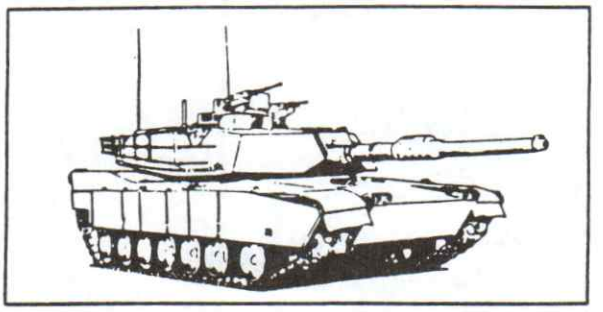
RADIOS and electronic rack below the gun may overheat. Cool them with wet rags. Do not cover vents. Use low power to assist in keeping heat levels down.

CHECK PLASTIC HUB CAPS on roadwheels carefully during PMCS. They can be punctured by sharp rocks and metal.

MAINTENANCE

MAINTENANCE IN A DESERT ENVIRONMENT cont

Abrams Tank



- **POL Tools.**
- **Wind Sensors.**
- **Heat Shields.**
- **Elevation Cylinder Filter.**
- **Oil Coolers.**
- **Host Nation HET Tires.**

ALL POL dispensing tools must be stored to protect them from dust and sand, i.e., grease gun ends covered, etc. Also, be sure to wipe grease fittings before and after lube.

WIND SENSORS should be cleaned and inspected at every opportunity. Keep them covered if not in use.

HEAT SHIELDS and guards for fuel tanks, combustor, and engine exhaust/rear grille doors must be in place. This will prevent or reduce likelihood of on-board fires.

ELEVATION CYLINDER FILTER should be checked weekly for cleanliness.

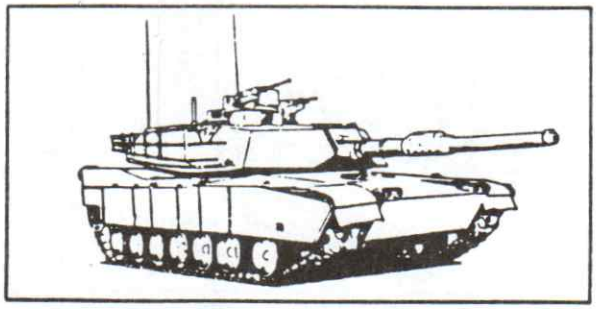
ENGINE AND TRANSMISSION OIL COOLERS and hydraulic heat exchangers exhaust large volumes of air. When restricted by dust, dirt, etc. they create overtemp conditions for drive train components. Check daily and keep coolers blown out with compressed air. Watch for warning light on driver's panel.

WHEN TRANSPORTING your tanks on host nation HETs, be sure they have replaced their "balloon" tires with U.S. type HET tires. Their "balloon" tires are designed for carrying lighter loads in the sand and will not hold up under the weight of the Abrams tanks on hard-surfaced roads.

MAINTENANCE

MAINTENANCE IN A DESERT ENVIRONMENT cont

Abrams Tank



- **WIND.**
- **MRS.**
- **HEAT SINK.**
- **AMMO DOOR.**
- **SCAVENGE FAN.**
- **GROUND HOPPING.**
- **CAMOUFLAGE NETTING.**
- **HEATER BLOWER.**

WHEN TACTICAL CONDITIONS permit, park tanks facing the wind to prevent sand and dirt from entering through grille doors.

SCAVENGE FAN should be checked daily for proper operation.

KEEP AMMO DOOR RAILS clean and free of sand and dirt.

WHEN GROUND HOPPING POWERPACKS, place powerpack on tarp.

USE CAMOUFLAGE NETTING to reduce radiant heat.

ENSURE HEAT SINK mounting hardware is in place.

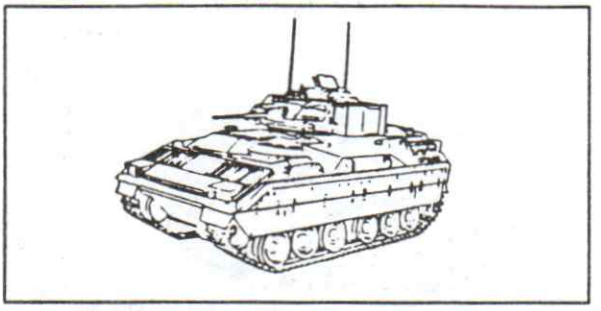
USE HEATER BLOWER (without heat) to circulate air in tank.

MORE FREQUENT MRS updates may be needed to compensate for gun droop.

MAINTENANCE

MAINTENANCE IN A DESERT ENVIRONMENT cont

M3 Cavalry Fighting Vehicle



- ISU.
- PTO. Bypass.
- Right Angle Fan.
- Final Drive.
- Transmission Vent Cap.
- Gun Trunion.
- Ballistic Sight.
- Wpn Sys Lube.
- Eye pieces.

THE FOLLOWING ARE BRADLEY SPECIFIC AND ARE IN ADDITION TO THOSE LISTED UNDER GENERAL MAINTENANCE TIPS.

TRANSMISSION VENT CAP must be checked and cleaned daily.

RIGHT ANGLE FAN should be checked daily to ensure proper lubrication and fuel level.

FINAL DRIVE must be checked daily to ensure dipstick tube is secured properly.

GUN TRUNION must be clean and dry at all times.

WEAPON SYSTEM LUBRICATION should be checked often. Keep it clean and lightly lubricated. Too much lubrication will collect dust and sand. Too little lubrication will cause seizures. Either way you will have misfires.

BALLISTIC SIGHT COVER DOOR should be closed when ISU is not in use.

COMMANDER'S AND GUNNER'S EYE PIECES should be covered when not in use to prevent the sand from scratching the lenses.

KEEP all glass, rubber, and leather surfaces clean and dry.

DO NOT look at the sun through ISU.

SET SENSOR SELECT SWITCH on ISU to neutral when using the ISU on bright, sunny days.

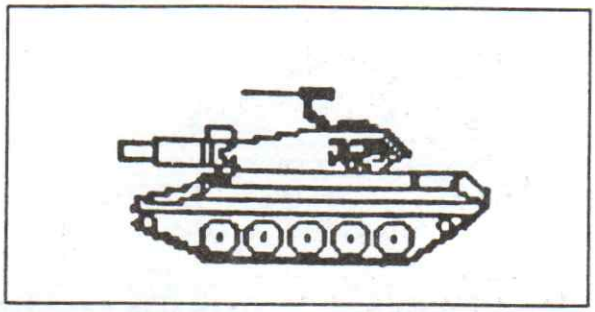
IF USING PTO BYPASS to send all power to the right-angle fan, use it sparingly since this use reduces power. Long term use could cause power-train damage.

MAINTENANCE

MAINTENANCE IN A DESERT ENVIRONMENT cont

M551A1 Sheridan

- **Surge Tank.**
- **Air Filter.**



- **Fuel Tanks.**
- **RW Hubs.**

- **Driver's Seat.**
- **Grenade Launcher.**
- **Electrical Contact Ring.**
- **Breech Mechanism.**
- **Obturator Seal.**
- **Dump Valve.**

THESE M551A1 SPECIFIC TIPS ARE IN ADDITION TO THOSE LISTED UNDER GENERAL MAINTENANCE TIPS WHICH MAY ALSO APPLY.

OVERLUBRICATED ROAD WHEEL HUBS may cause damage to road wheel seals, especially in hot climates. After movement or during maintenance halts, put no more than 5 pumps of grease into each hub or stop adding grease as soon as grease comes out the relief valve. Use of aircraft grease is recommended.

CLEAN AIR FILTERS twice daily or more often if needed. Engine power losses and/or excessive black exhaust smoke are indicators that air filters are dirty.

CHECK SURGE TANK twice daily to ensure coolant level is maintained. Ensure surge tank gasket is in place.

FUEL TANKS should be filled to 6 inches below filler neck.

DO NOT LUBE DRIVER'S SEAT. Keep clean and dry.

DO NOT OIL grenade launcher tubes. Keep clean and dry and covered if possible.

ELECTRICAL CONTACT RING should be inspected/cleaned daily.

BREECH MECHANISM should be kept clean and dry.

OBTURATOR SEAL should not be lubed.

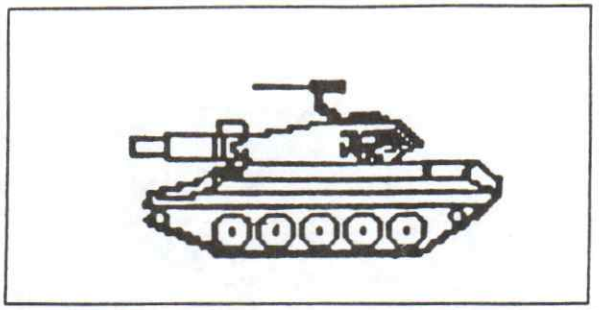
ENSURE MOISTURE DUMP VALVE ON AIR COMPRESSOR remains open. Clean and check daily.

MAINTENANCE

MAINTENANCE IN A DESERT ENVIRONMENT cont

M551A1 Sheridan

- POL.
- Water.



- Main Gun Ammo.
- LRF.
- Missile Tracker.
- IR Searchlight.
- Receiver-Transmitter Blower.

POL PRODUCTS should match the environment. In contained mechanisms, GAA should be replaced by aircraft grease. If items do not require lubrication for actual function, they should be kept clean and dry.

ENGINE WATER LEVELS need to be closely monitored, and all caps and gaskets on water and oil points should be kept clean and serviceable.

WATER USE IN SHERIDAN UNITS is higher than in other Armor units since the M551A1 requires water.

MISSILE TRACKER should be realigned in morning and again after temperature drops in the evening.

LRF failure due to high heat can be avoided by placing a wet towel over LRF and mount, keeping it shaded until needed.

CLEAN RECEIVER-TRANSMITTER BLOWER air intake and exhaust ports daily.

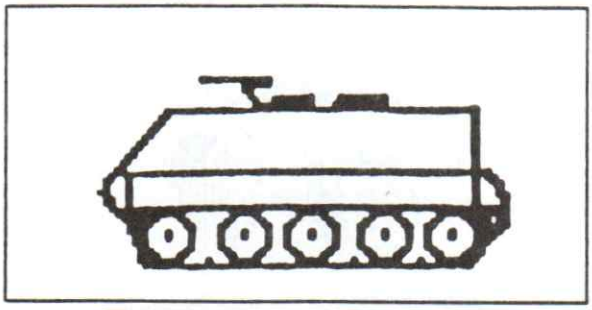
KEEP IR SEARCHLIGHT air intake and exhaust ducts clean and dry.

KEEP ALL MAIN GUN AMMUNITION covered, shaded, and out of direct sunlight.

MAINTENANCE

MAINTENANCE IN A DESERT ENVIRONMENT cont

M113 Family of Vehicles



- **Track.**
- **Seat Rails.**
- **Air Hoses.**
- **Fresh Grease.**
- **Vent Tube.**
- **Range 1-4.**

THESE TIPS ARE M113-FAMILY SPECIFIC AND ARE IN addition TO THOSE ITEMS COVERED BY THE GENERAL MAINTENANCE TIPS.

CHECK TRACK frequently. Sand causes excessive wear on the track bushings.

KEEP SEAT RAILS CLEAN and dry or sand will collect on them and hinder operations.

FOR THE M113A3, set the Electric Transmission Controller (Gear Shift Lever) to Range 1-4 unless it is absolutely necessary to drive in lower ranges. Use of the 1-4 Range reduces strain on the power train, thereby reducing failure rates.

VENT TUBE ON TRANSMISSION FILL CAP must be checked and cleaned daily to prevent clogging.

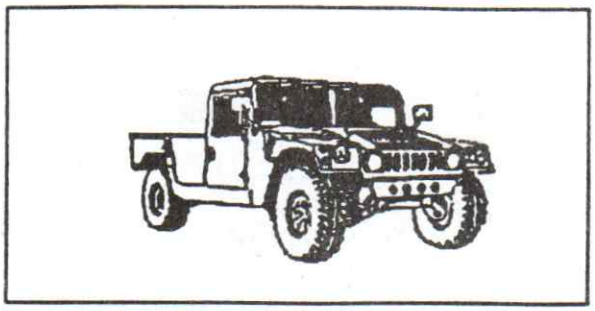
RECOMMEND AIR HOSES be issued to each track so that all available air supplies can be used to clean air filters. Remember, the pressure must be 30 PSI or less to prevent filter damage.

PUMP FRESH GREASE INTO ROAD WHEEL HUBS 3 TIMES DAILY to keep sand from packing around the inner and outer seals.

MAINTENANCE

MAINTENANCE IN A DESERT ENVIRONMENT cont

Wheel Vehicles



- **Belts.**
- **Axle Vents.**
- **CV Boots.**
- **Plywood.**
- **Std XM & SF Gearcase Vents.**
- **Air Compressor Intake Filters.**

THESE TIPS ARE WHEEL VEHICLE SPECIFIC AND ARE IN ADDITION TO THOSE LISTED IN THE GENERAL MAINTENANCE TIPS.

ALL BELTS must be checked daily. Sand will cause excessive wear on belts and pulleys, causing the belts to become loose.

CARRY A PIECE OF PLYWOOD or other materiel of sufficient size and strength for use as a base for the vehicle jack.
If used without a base, the jack will sink into the sand.

AXLE VENTS must be checked and cleaned daily to prevent clogging and blown gaskets.

STANDARD TRANSMISSIONS AND TRANSFER GEARCASE VENTS must be checked and cleaned daily.

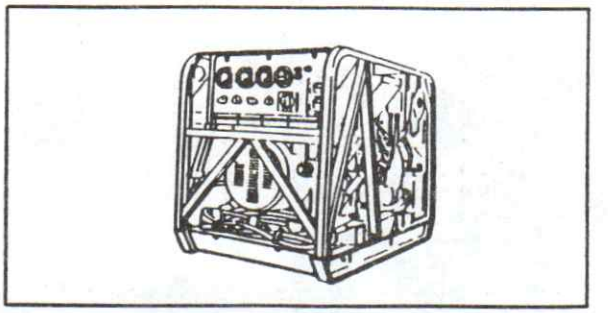
CV BOOTS ON FRONT WHEEL DRIVE AXLES must be checked daily for rips, tears, and improper mounting.

AIR COMPRESSOR intake filters must be cleaned daily.

MAINTENANCE

MAINTENANCE IN A DESERT ENVIRONMENT cont

Power Generators



- **Fuel Filters.**
- **Air Filters.**
- **Condensation.**
- **Doors and Shrouds.**
- **Radiator Shutters.**
- **"Splash" Type Lube.**

THESE ARE POWER GENERATOR SPECIFIC TIPS. SEE THE GENERAL MAINTENANCE SECTION FOR OTHER TIPS THAT MAY APPLY.

FUEL FILTERS must be drained daily.

AIR FILTERS must be cleaned as soon as dust is evident. Replace if filter is clogged, torn, or damaged.

REDUCE CONDENSATION by topping off the fuel tank at sundown.

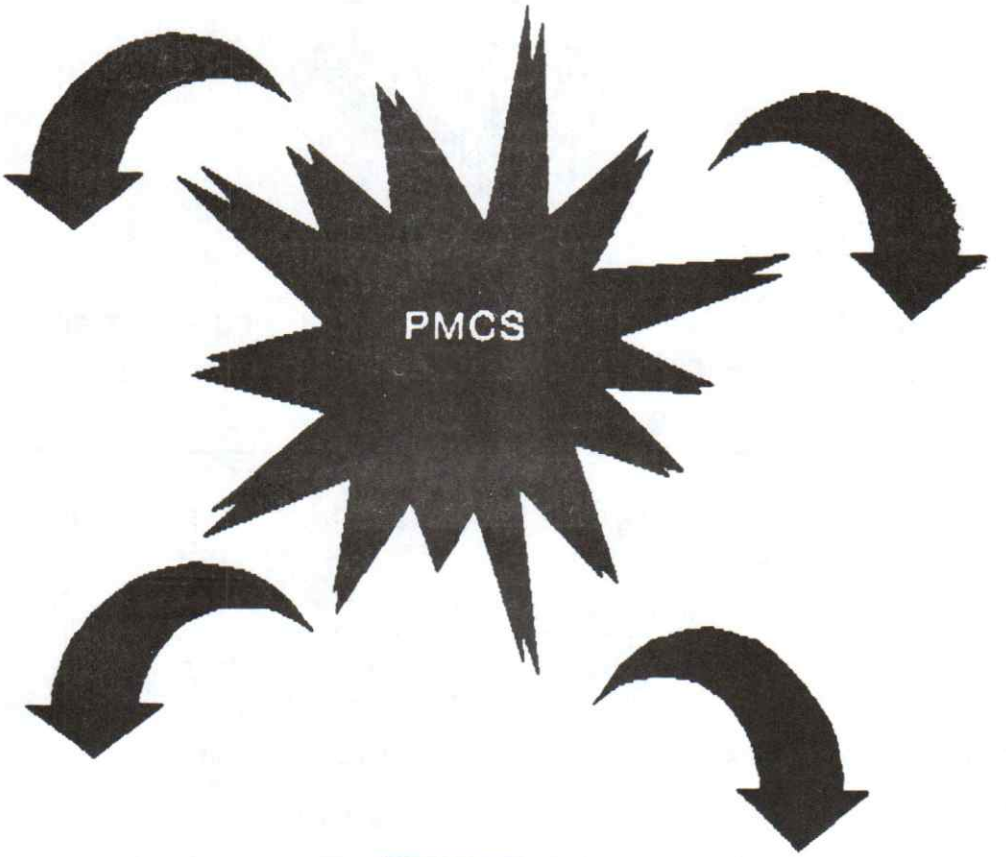
CLOSE DOORS AND SHROUDS to keep the generator cool.

RADIATOR SHUTTERS on the 15 KW or larger diesel generators should never be blocked open. This keeps the generator from reaching operating temperature, even in the desert. If the generator runs cold, its oil turns to sludge — and it slobbers. Make sure, though, that the shutters do flip open when the generator reaches operating temperature. Otherwise, the generator overheats in no time.

SMALL GENERATORS WITH "SPLASH" TYPE lubrication systems must be level during operation to prevent bearing seizure.

MAINTENANCE

MAINTENANCE IN A DESERT ENVIRONMENT



PROPER PMCS IS *CRITICAL* FOR DESERT OPERATIONS!

CHAPTER 6

WEAPONS LETHALITY AND GUNNERY CONSIDERATIONS

This chapter covers two areas:

- Main Gun Lethality
- Special Gunnery Considerations in Desert Operations
  - Optical Refraction
  - Alternative Boresighting Techniques
  - MRS Procedures

INTRODUCTION

PURPOSE. TO PROVIDE INFORMATION TO THE FIELD NOT CURRENTLY FOUND IN THE LATEST TANK-RELATED FIELD MANUALS AND TECHNICAL MANUALS. THIS CHAPTER IS DIVIDED INTO 2 SECTIONS:

WEAPON LETHALITY COVERS GENERAL RULES OF ENGAGEMENTS BASED ON REGIONAL THREAT. (A CLASSIFIED COMPREHENSIVE DESCRIPTION OF U.S. WEAPON LETHALITY WILL BE PUBLISHED SEPARATELY AS AN ADDENDUM TO THIS DOCUMENT.)

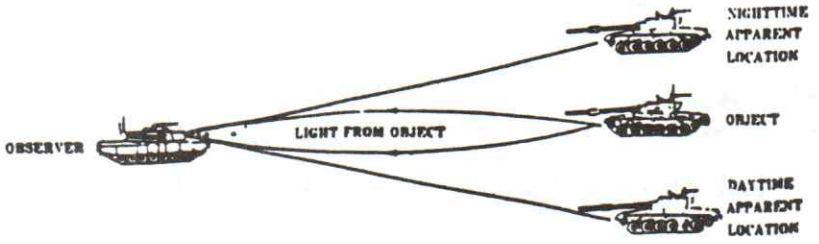
SPECIAL GUNNERY CONSIDERATIONS DETAILS THE EFFECTS OF OPTICAL REFRACTION IN THE DESERT AND OFFERS RECOMMENDATIONS FOR GUNNER AIM. THIS PORTION ALSO PROVIDES AN ALTERNATIVE BORESIGHTING TECHNIQUE WHEN THE SITUATIONS AND CONDITIONS REQUIRE BORESIGHTING THE ABRAMS UNDER LESS THAN FAVORABLE CONDITIONS. ALSO INCLUDED ARE MRS PROCEDURES DURING DESERT OPERATIONS.

WEAPONS LETHALITY

ENGAGEMENT AND PLANNING RANGES FOUND IN FIELD MANUALS ARE STILL VALID; TANKS ARE CAPABLE OF HITTING AND KILLING IRAQI TANKS AND ANY OTHER WEAPON SYSTEMS YOU MAY ENCOUNTER.

A CLASSIFIED ADDENDUM TO THIS DOCUMENT (TO BE PUBLISHED), WILL PROVIDE DETAILED INFORMATION ON HIT AND KILL PROBABILITIES FOR ALL MAIN GUN AMMUNITION TO ASSIST YOU IN ESTABLISHING PROPER ENGAGEMENT PLANNING RANGES FOR ALL MAIN GUN AMMUNITION AGAINST TANKS AND OTHER ARMORED SYSTEMS FOUND IN THE IRAQI ARMY.

OPTICAL REFRACTION



REFRACTION - BENDING OF LIGHT RAYS

- BORESIGHTING & ZEROING WON'T CORRECT
- DEPENDS ON TIME OF DAY

• LONG-RANGE TANK GUNNERY IN DESERTS CAN BE AFFECTED BY REFRACTION.

• REFRACTION CAUSES THE APPARENT ELEVATION OF A TARGET TO MOVE UP OR DOWN.

- THE MOVEMENT IS BASED ON TEMPERATURE DIFFERENCES BETWEEN THE AIR AND THE SURROUNDING TERRAIN.

• THE EFFECTS OF OPTICAL REFRACTION IN DESERTS:

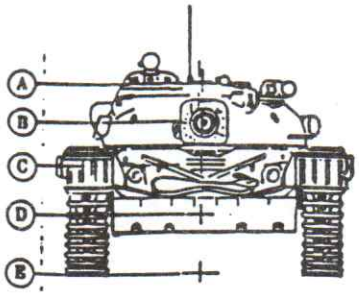
- IS MUCH LIKE THAT OF PLACING A STICK INTO A POOL OF WATER; THE STICK APPEARS TO BEND SHARPLY AT THE SURFACE.

- CANNOT BE REDUCED BY EITHER BORESIGHTING OR ZEROING.

• TANK CREWS MUST BE AWARE OF THIS PHENOMENON AND LEARN HOW TO ADJUST FOR IT.

RULE OF THUMB

AIM POINTS



CONDITIONS:

A: CLEAR SKY, FLAT DESERT, DAYTIME, WINDS <10 MPH, 2,500 TO 3,500 m RANGE
B: CLEAR SKY, FLAT DESERT, DAYTIME, WINDS <10 MPH, 1,500 TO 2,500 m RANGE
C: DAWN OR DUSK, CLOUDY SKY, HIGH WINDS, RUGGED TERRAIN OR RANGE <1,500m
D: CLEAR SKY, FLAT DESERT, NIGHT, WINDS <4 MPH, 1,500 TO 2,500 m RANGE
E: CLEAR SKY, FLAT DESERT, NIGHT, WINDS <4 MPH, 2,500 TO 3,500 m RANGE

BORESIGHT AND ZERO ONLY AT DUSK OR DAWN.

- **TRY TO BORESIGHT AND ZERO AT DAWN OR DUSK; THESE ARE THE TIMES WHEN THE EFFECTS OF OPTICAL REFRACTION ARE THE LEAST.**

- **CREWS SHOULD AIM 1/4 MIL HIGHER THAN CENTER OF MASS AT RANGES 1,500-2,500 AND 1/2 MIL HIGHER AT RANGES BEYOND 2,500 METERS DURING THE HEAT OF THE DAY IF WINDS ARE LESS THAN 10 MPH.**

- **CREWS SHOULD AIM 1/4 MIL LOWER THAN CENTER OF MASS AT RANGES 1500-2500 AND 1/2 MIL LOWER AT RANGES BEYOND 2500 METERS DURING THE MIDDLE OF THE NIGHT IF WINDS ARE LESS THAN 10 MPH.**

- **CREWS SHOULD AIM CENTER OF MASS OF A TARGET AT RANGES CLOSER THAN 1500 METERS, OR IF THE WIND EXCEEDS 10 MPH.**

- **OPTICAL REFRACTION IS NEGATED IF THE FIRING TANK IS 10 METERS HIGHER IN ELEVATION THAN THE TARGET.**

- **REMEMBER–"SUN UP–SIGHTS UP; SUN DOWN–SIGHTS DOWN."**

(M1/M1A1 USE ONLY)

ALTERNATE BORESIGHTING TECHNIQUE

• **NORMAL BORESIGHTING SHOULD BE DONE AT DAWN AND DUSK TO ALLEVIATE OPTICAL REFRACTION PROBLEMS.**

• **IF THE SITUATION ARISES THAT YOU MUST BORESIGHT DURING THE MIDDLE OF THE DAY AND REFRACTION OR SPACE RESTRAINTS PREVENT YOU FROM USING A 1,200 METER TARGET, THE FOLLOWING PROCEDURES WILL GIVE A 1,200 METER BORESIGHT USING A 500 METER PANEL.**

• **PROCEDURES**

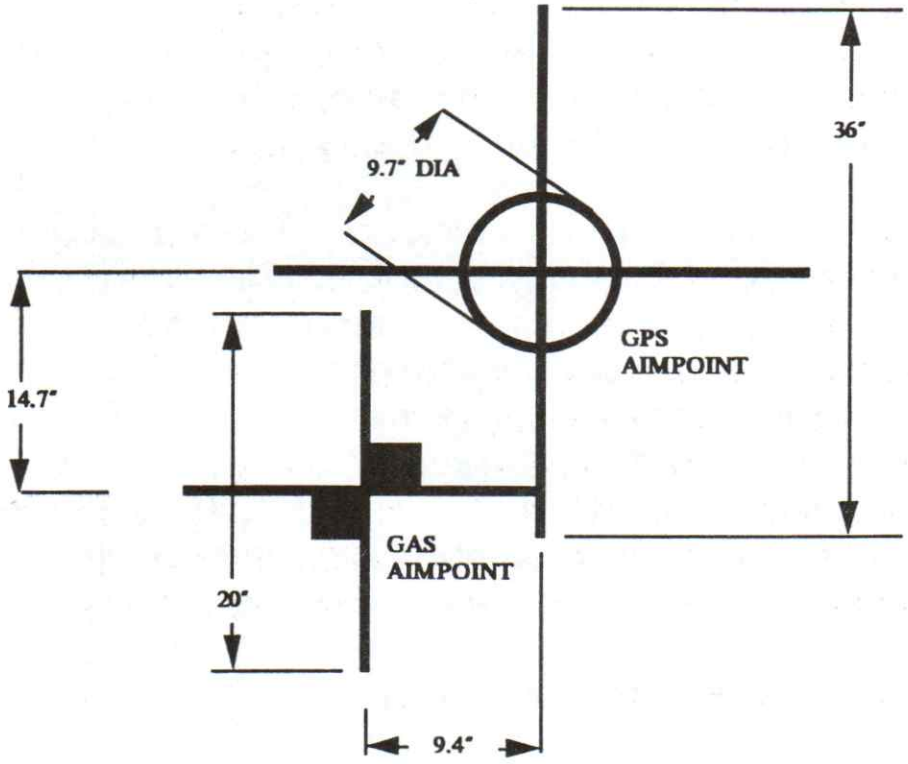
- ***BORESIGHT THE GUNNER'S PRIMARY SIGHT (GPS)***

1. **PARK TANK ON LEVEL GROUND.**
2. **PREPARE GUNNER'S STATION FOR OPERATION.**
3. **SET BORESIGHT PANEL AT 500 METERS.**
4. **LASE TO THE TARGET, OR INDEX 500 METERS INTO THE COMPUTER.**
5. **INSERT MUZZLE BORESIGHT DEVICE.**
6. **USE STANDARD BORESIGHT PROCEDURES TO ALIGN GPS AND THE MUZZLE BORESIGHT DEVICE (MBD) TO THE GUN/GPS AIMPOINT (SEE DIAGRAM).**
7. **REMOVE MBD AFTER GPS BORESIGHT.**

- ***BORESIGHT THE GUNNER'S AUXILIARY SIGHT (GAS)***

1. **MANUALLY INDEX 1,200 METERS INTO THE COMPUTER.**
2. **SQUEEZE PALM SWITCH TO ENTER BALLISTIC SOLUTION INTO THE FIRE CONTROL SYSTEM.**
3. **SET FIRE CONTROL MODE TO EMERGENCY.**
4. **SET GAS RETICLE TO SABOT.**
5. **USE MANUAL CONTROLS TO LAY GPS ON THE GUN/GPS AIMPOINT.**
6. **USE AZIMUTH (AZ) AND ELEVATION (EL) KNOBS TO LAY GAS ON GAS AIMPOINT (SEE DIAGRAM).**
7. **ROTATE THE AZIMUTH AND ELEVATION SCALES UNTIL "0" ALIGNS WITH INDEX MARKER.**

ALTERNATE BORESIGHT PANEL
(M1/M1A1 USE ONLY)



NOTE: NOT TO SCALE

ALL TARGET LINES ARE 1 INCH WIDE

GAS TARGET SQUARES ARE 2"x 2"

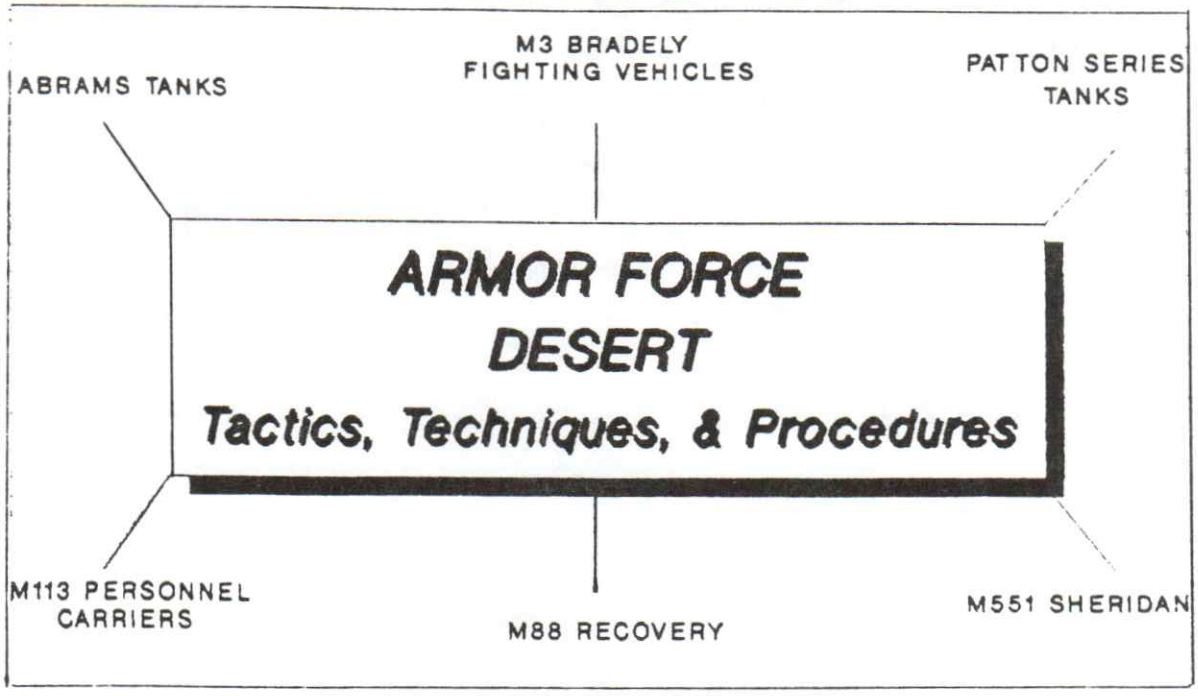
TARGET TO BE USED MUST BE AT 500 METERS

MRS PROCEDURES

1. THE MRS IS A FIELD EXPEDIENT DEVICE TO HELP CORRECT FOR BORESIGHT LOSS, EITHER THROUGH FIRING OR WHILE THE TANK SITS STATICALLY. GREATER ACCURACY IS NORMALLY ACHIEVED BY BORESIGHTING WITH A MUZZLE BORESIGHT DEVICE (MBD), WITH 1,200 METERS AS THE RECOMMENDED RANGE. CLIMATIC CONDITIONS DURING DESERT SHIELD, HOWEVER, MAY REQUIRE THAT THE MRS BE USED MORE OFTEN THAN IN THE PAST.

2. REFRACTION MAY CREATE PROBLEMS FOR THE GUNNERS IN MAKING THEIR FINAL PRECISE LAY DURING BORESIGHTING. TANK CREWS MAY ONLY BE ABLE TO BORESIGHT THEIR TANKS AT 1,200 METERS DURING THE EARLY MORNING AND/OR EARLY EVENING HOURS WHEN THE REFRACTION PROBLEM IS MINIMAL. THEREFORE, IN ORDER TO MAINTAIN OPTIMUM MAIN GUN ACCURACY, CREWS SHOULD PERFORM MRS CHECKS ON AN HOURLY BASIS DURING THE DAY AFTER THE INITIAL BORESIGHT AT 1,200 METERS HAS BEEN PERFORMED. MRS CHECKS THAT SHOW AN UPDATE OF 0.15 MIL OR GREATER SHOULD BE ENTERED INTO THE COMPUTER. IF CLIMATIC CONDITIONS ALLOW, THE CREWS SHOULD REBORESIGHT AT 1,200 METERS AS FREQUENTLY AS CONDITIONS ALLOW.

CHAPTER 7
TACTICS, TECHNIQUES, & PROCEDURES



This chapter will cover the tactics, techniques, and procedures that will impact Armor personnel operating in the desert environment. It will cover information that is not found in other sources or information that needs to be highlighted. Some of the areas covered are:

- Desert Operations.
- IPB.
- Reconnaissance.
- Combat Support.
- Combat Service Support.
- Offensive Operations.
- Defensive Operations.
- Heavy/Light Forces.

OPERATIONS
OBJECTIVE

- FORCE THE MOBILE FORCES AWAY FROM THE NONMOBILE FORCES AND DESTROY SEPARATELY
- THREATEN ENEMY LINES OF COMMUNICATION AND RESUPPLY
- ROB THE ENEMY OF THE INITIATIVE BY MAKING HIM REACTIVE

OBJECTIVE

In the desert the main endeavor is to concentrate forces in space and time to split the enemy forces in depth and destroy them at different times. When not in prepared defensive positions, nonmobile units are very vulnerable to their mechanized counterparts. When operating against a mixture of mobile and nonmobile forces, the defeat of the mobile forces leaves the nonmobile assets trapped in their defensive positions without the ability to gain the initiative.

Due to a heavy dependence on logistical support in the desert, the destruction of the logistical supply lines makes the strongest defensive position untenable in time.

In the desert more than in any other terrain, control of the initiative is critical. A military force cannot be successful based solely on defense. With the large spaces provided in the desert, maneuver becomes a fast-paced series of movements to identify and strike the enemy flanks. This causes the commander to rely on maneuver as the critical factor over dismounted operations. The mechanized unit with long-range weapon systems becomes the force to maneuver and create the points of vulnerability for infantry exploitation.

OBSERVATION AND FIELDS OF FIRE

- MAXIMUM USE OF THERMALS
- DISMOUNTED ACTIONS
- NOISE DISCIPLINE

OBSERVATION AND FIELDS OF FIRE.

Make maximum use of thermal sights by having M1s in close support of scouts assisting in observation, having handheld thermals with dismounted scouts, and putting M3 thermals in mounted OPs.

In dismounted actions the commander must increase patrolling, practice dismounting more often as part of drills, and equip some soldiers with handheld thermal, while others use binoculars.

OBSCURANTS AND FOG

- USE TIGHTER FORMATIONS
- LOCATE TANKS CLOSER TO SCOUTS PROVIDE OVERWATCH
- DISMOUNT SCOUTS FOR EFFECTIVE INFILTRATION AND PATROLLING
- INCREASE USE OF AIR-GROUND TEAM

OBSCURANTS AND FOG

Use tighter formations, and deploy unit on narrower frontages.
Expect and plan for navigation problems.
Locate tanks closer to scouts to provide overwatch.
Dismounted scouts are even more effective for infiltration and patrolling, because movements are harder for the enemy to detect.
Increase use of air-ground team as aeroscouts can often see farther because of their elevated platform.
To maintain noise discipline, units should make maximum use of silent watch; turn off all speakers on radios.

IPB

- BATTLEFIELD EVALUATION
  - FORCES CONDUCT HIGHLY MOBILE OPNS
  - AREA OF OPERATION AND AREA OF INTEREST INCREASE IN SIZE.
- TERRAIN ANALYSIS
  - MAPS GENERALLY INACCURATE
  - ABSENCE OF REFERENCE POINTS
  - OBTAIN PHOTOS, HUMAN INTELL
  - CONDUCT EXTENSIVE GROUND RECON

IPB
BATTLEFIELD AREA OF EVALUATION

In desert operations, areas of operation will be increased from what is normally assigned by higher headquarters. You will find this to be true because of the increased visibility and fields of fire available. In a higher headquarters, particular attention should be given to ranges of weapon systems. In a light infantry unit, its weapons become the restrictive resource which constrains the physical frontage. The requirements of mutual support and depth in open terrain also play a significant contributing factor. For light infantry, their relative tactical mobility in this type of terrain must be considered a weakness. The mobility of mechanized and armor units makes them stronger, which may drastically change the size of their areas of operation.

The area of interest for the S/G-2 and commander at all levels increases because it is a factor of time and space. In the desert, the enemy can influence the close battle much more quickly over a much greater distance.

Inaccuracies on maps prevent a good analysis of reference points, dead space, mobility corridors, and slow-go terrain. Supplemental resources for the lay of the ground must be sought. Physical reconnaissance, intelligence from local inhabitants, and route reconnaissance feedback from scouts will be essential. Small discriminations in terrain should be identified, recorded, and disseminated.

IPB

- OBSERVATION AND FIELDS OF FIRE
  - OBSERVATION AFFECTED BY :
    - ✓ LONG RANGES AND REFRACTION
    - ✓ HEAT WAVES
    - ✓ ESTIMATION OF DISTANCE
    - ✓ MIRAGES
- COVER AND CONCEALMENT
  - COVER LACKING, EXCEPT NEAR URBAN AREAS
  - CONCEALMENT DIFFICULT

IPB
OBSERVATION AND FIELDS OF FIRE

Two primary considerations in the desert environment are longer range observation, and fields of fire at maximum effective ranges. However, rapid heating and cooling of the atmosphere hinder these factors. This causes distortion of range to the aided and unaided eye. Mechanical and electronic means must be used to verify estimated ranges such as GSR, laser range finders, boresight and zero more often than normal at max ranges. Special care must be taken when range lazing because if the target is missed an inaccurate return will result. To increase accuracy, range to the target with more than one system from more than one position. (WARNING: If the enemy is equipped with laser warning devices, this technique should be used sparingly for OPSEC purposes.) See weapons discussion for more detail.

Cover and concealment are generally scarce in the desert. They are restricted to discrete folds in the ground, wadis, and buildings near urbanized areas. Vegetation is virtually nonexistent with the exception of cultivated areas around oases or urban areas. Depending on the type of desert, some ground cover may provide limited concealment to dismounted troops. Man-made cover and concealment will have to be used extensively in static positions. Terrain driving is an art in the desert that must be practiced at all times. Deception techniques are used by enemy and friendly units such as dummy positions and faint dust trails to counter this disadvantage. Therefore, seeing a dust trail or position is only an intelligence indicator not a hard fact to base decisions. Actual enemy size and activity is required.

IPB

- OBSTACLES
  - VARIED BY TYPE OF DESERT
- KEY TERRAIN
  - LACK OF TRADITIONAL KEY TERRAIN
  - AVAILABILITY OF WATER
  - OTHER RESOURCES
  - OPERATIONS TEND TO BE MORE FORCE ORIENTED, RATHER THAN TERRAIN ORIENTED
- AVENUES OF APPROACH
  - GENERALLY PROVIDE FOR RAPID MOVEMENT
  - MORE THAN AMPLE MANEUVER SPACE

IPB

OBSTACLES - KEY TERRAIN - AVENUES OF APPROACH

In mountain deserts, rocks and relief may provide varied forms of obstacles. Wadis may form natural tank ditches.

In flat, sandy deserts, the shifting sand dunes provide the only significant obstacle, and they may not be obstacles. That depends on the slope of the dune and trafficability of the sand which makes up the dune.

The desert lacks the traditional terrain associated with key terrain. Natural resources such as oil, water, and food become key locations. Static locations of enemy and friendly troop concentrations are key terrain. This pertains primarily to less mobile forces such as support operations or light infantry. More traditional key terrain, such as histrionic astride a mountain pass or ground that overwatches a wadi, mobility corridor may be more likely found in a mountain plateau desert.

Avenues of approach in the desert provide for rapid movement and ample maneuver space. Because of the lack of restrictive terrain and key terrain it is difficult to guess where the enemy will go or what his intentions are. One of the ways to do this is identify where his objectives might be, then trace the most likely routes back to his current location. Remember that the enemy has just as much trouble navigating as you have determining which way he will go.

IPB

- WEATHER ANALYSIS
  - WIDE VARIATION IN TEMPERATURES
  - FREQUENT AND EXTREME CHANGES
  - WIND, TEMP, TRAFFICABILITY, FLASH FLOODS
  - SOMETIMES FAVORS NBC USE, SOMETIMES DOES NOT
- NAMED AREAS OF INTEREST (NAI's)
  - MUST COVER ALL DIRECTIONS
  - MAXIMIZE LONG RANGE COLLECTION ASSETS TO THE FRONT AND FRONT FLANKS
  - FACILITATE COVERAGE THROUGH ENTIRE DEPTH OF AREA OF OPERATION
- TARGET AREAS OF INTEREST (TAI's)
  - PLACE AT MAX RANGES
  - USE DIRECT, INDIRECT, LETHAL AND NON-LETHAL

IPB

WEATHER ANALYSIS - NAI'S - TAI'S - INTELLIGENCE SOURCES.

Deserts experience wide variations in temperature between day and night. Frequent and extreme changes in weather often occur such as dust storms, change in wind direction, and occasionally harsh rain storms with accompanying flash floods. Wind storms can reduce visibility, noise detection, and detection of dust signatures. Rain can also reduce dust signatures, but they can severely limit trafficability as well. The moon's rise and set affect night visibility significantly for passive night vision devices and the naked eye.

In the desert, NAIs are used to focus reconnaissance and surveillance planning. It should be understood that these areas will not be exact as in other types of terrain. Scouts and other assigned units must use these locations to orient, but they should also use initiative to adjust those areas based on METT-T observed on the ground. Units must report what they see or don't see and any modifications that were made to the assigned area. They should be placed at maximum ranges of direct and indirect fires, lethal and nonlethal.

IPB

- INTELLIGENCE SOURCES
  - IMMEDIATE EPW INTERROGTION
  - INFILTRATORS, TERRORISTS, SABOTEURS, REFUGEES, AND LOCAL INHIBITANTS
- INTELL AND ELECTRONIC WARFARE (IEW)
  - FOCUS IEW ASSETS AT MAX RANGES AT FRONT AND FRONT FLANKS
  - USE/REQUEST HIGHER LEVEL'S ASSETS
  - RADIO SYSTEMS VULNERABLE TO JAMMING
  - WIDE DISPERSAL OF IEW ASSETS FOR LESS VULNERABILITY

INTELLIGENCE SOURCES.

Human intelligence sources, satellite, and aerial photos are extremely perishable information in the mobile desert environment. Therefore, it must be disseminated to those who need it as quickly as possible. Interrogation teams should be as far forward as possible.

IEW

Due to the increased size of the desert area of operation and area of interest, IEW assets should be well forward and mobile to accomplish their missions. It will be extremely difficult to conduct mission support and still mask its signals from the enemy. Antenna placement and camouflage, as well as dispersion will play key roles in the survival of these important reconnaissance and surveillance assets.

RECONNAISSANCE

- PROVIDE EXACT ENEMY DEPLOYMENT
- PROVIDE COMMANDER TIMELY INFORMATION ON CHANGES IN ENEMY ACTIVITY
- DETER OR DESTROY ENEMY RECONNAISSANCE EFFORTS
- CONFUSE ENEMY AS TO OUR OBJECTIVES OR DEFENSIVE POSITIONS
- IDENTIFY ENEMY WEAKNESS FOR EXPLOITATION

RECONNAISSANCE

In the desert, operations are very enemy orientated. This requires that exact information of the enemy deployment is critical to effective operations.

To take and retain the initiative, reconnaissance elements must provide the commander with timely information and any changes in enemy activity.

Destroying or deterring the enemy reconnaissance effort prevents the enemy from seeing the battlefield. This increases the survivability of our forces and allows us to employ the element of surprise.

The other effect of aggressive counterreconnaissance is to confuse the enemy and prevent it from identifying the true nature of our objectives. This prevents him from shifting forces in reaction to our movements.

Proper reconnaissance in the desert will identify weaknesses in enemy operations that can be exploited quickly. This keeps the enemy from developing momentum in the attack or from consolidating an effective defense.

RECONNAISSANCE AND SECURITY

- TERRAIN
  - LACK OF RESOURCES
  - EXCELLENT OBSERVATION
  - EXCELLENT FIELDS OF FIRE
  - LACK OF CONCEALMENT
- SECURITY OPERATIONS IN THE DESERT
  - ALL AROUND SECURITY
  - AGGRESSIVE/CONTINOUS RECON
  - AVOID OBVIOUS LOCATIONS
- OTHER CONSIDERATIONS
  - DUST SIGNATURES

RECONNAISSANCE AND SECURITY

Along with the environmental aspects of desert operations, the lack of both natural and man-made CSS assets causes CSS assets to be more numerous and spread out. This makes excellent reconnaissance targets due to long range observation and fields of fire coupled with a lack of concealment.

Security operations in a desert environment must emphasize all-around security provided by aggressive and continuous reconnaissance, establishing OPs on high ground, coupled with the effective use of camouflage. Obvious OP locations should be avoided as they are likely TRPs. Additionally, use radars, sensors, and observation devices to provide additional security, especially at night.

Other considerations are dust from NOE flight, which can be seen as far as 30 km. This is especially true when the enemy is stationary. Aeroscouts must use caution to avoid blundering into enemy AD weapons. The dismount-and-scan technique is effective for aircraft to provide security for themselves. Additionally, movement should be done at maximum tactical speed permitted by the terrain and dust conditions. In some situations, movement may be slowed to reduce dust signature. In certain circumstances, there may be no alternative to maneuver in terrain where the enemy has long range observation. Then it is necessary to move at the best speed possible while indirect fires are placed on suspected enemy positions.

Observation of fires, especially direct fires by tanks, may be difficult due to dust clouds. Wingmen may have to observe direct fires. Dust signatures can also be created as a deception.

RECONNAISSANCE AND SECURITY (CONT)

- NAVIGATION
  - TERRAIN ASSOCIATION
  - AZIMUTH WITH ODOMETERS
  - GSRs
  - ARTILLERY FIRES
  - STABILIZATION SYSTEMS
- DISMOUNTED SCOUTS

Leaders should navigate in the desert using terrain association when possible. This may, in some places, be difficult due to lack of relief. Use GSRs, tracer fires, artillery fires, etc., to confirm location. Use odometers, compass, and pace to track distance traveled from known points.

Dismounted scouts should be employed in all passes. They can be used for patrolling in rocky terrain. Ensure scouts are sufficiently armed to destroy enemy scouts who may be at the same location as the planned insertion.

Commanders should use air cavalry to check terrain which is inaccessible to armored vehicles. Air cavalry can also recon large, flat, open areas rapidly. Air cavalry is much more vulnerable to ADA fires in the desert. Helicopters may have to operate higher than normal to avoid dust signature from rotor wash. Reconnoiter with the sun and escarpment as backgrounds when possible.

Commanders may decide to modify formations in the desert to provide overwatch of scouts. The desert normally provides extremely long fields of fire for enemy forces. Because of this, it is easier to detect scouts and engage them at long range.

Employ all reconnaissance assets forward, but plan for rotation of assets during extended operations.

RECONNAISSANCE AND SECURITY (CONT)

- AIR CAVALRY
- COMMANDERS
- MAXIMUM RECONNAISSANCE FORWARD
- ORIENT ON THE LOCATION OR MOVEMENT OF OBJECTIVE/ENEMEY FORCE
- REPORT RAPIDLY ALL INFORMATION
- MAINTAIN FREEDOM OF MANEUVER
- MAINTAIN ENEMY CONTACT

Long range observation makes it difficult to infiltrate into and through main defensive belts. Wadis and ridges do provide, however, a concealed route for dismounted or mounted elements attempting to infiltrate. Scouts should employ terrain driving techniques using wadis and folds in the ground. Night often has good illumination from ambient light. The naked eye and binoculars can be almost as effective as in the day. If possible, reconnoiter with the sun at your back; this reduces the enemy's ability to acquire you. Use dust and sand storms like smoke. Increased range of observation allows reconnaissance elements to have larger zones. Allow time for scouts to thoroughly reconnoiter passes, escarpments, and outcroppings using dismounted techniques. GSRs are still effective when heat distorts optical vision.

Thermals are better at night when difference in ambient temperatures is greater. Avoid shines and reflections as much as possible. Ranges to targets may be distorted from heat rising from the desert surface. Use range finders to verify correct distances. Be prepared to use bracketing techniques with large adjustments to hit an enemy target with artillery.

RECONNAISSANCE AND SECURITY (CONT)

- LONG RANGE OBSERVATION MAKES IT DIFFICULT TO INFILTRATE
- SCOUTS SHOULD EMPLOY TERRAIN DRIVING TECHNIQUES
  - WADIS
  - DUNES
  - FOLDS IN THE GROUND
- GOOD AMBIENT LIGHT OFTEN AT NIGHT
- RECONNOITER WITH SUN TO BACK IF POSSIBLE

RECONNAISSANCE AND SECURITY
(CONT)

Orient on the Location or Movement of the Reconnaissance Objective- Focus the direction of the reconnaissance on an enemy force or terrain feature.

Report all Information Rapidly and Accurately - Providing raw combat information quickly to the higher unit commander and staff is the most important result of reconnaissance.

Retain freedom of maneuver. Avoid decisive engagement by using secure movement techniques.

Gain and maintain enemy contact. Track enemy movements and activities continuously.

MOBILITY

- RECON OBSTACLE
- BYPASS OBSTACLE
- BREACH OBSTACLE
- TASK ORGANIZE FOR IN-STRIDE BREACHING

MOBILITY

Desert terrain facilitates bypassing enemy obstacles, but first exact reconnaissance must be performed to determine if bypasses is what the enemy wants. The enemy emphasizes rapid minefield emplacement for both conventional mines and scatterable mines so the friendly commander must task organize for in-stride breaching.

The application of the fundamentals of breaching; suppress, obscure, secure, and reduce--and the organization of the force in terms of support, breaching, and assault elements are not unique to the desert. However, the desert does offer greater opportunities to bypass enemy obstacles because of the greater range of mobility afforded by desert terrain. Caution must be exercised when choosing to bypass enemy obstacles since the bypass may lead the force to the enemy's engagement area. Additionally, the threat in the desert can be expected to make extensive use of rapid mine laying techniques. These techniques include scatterable mine delivery systems as well as more conventional methods of mine emplacement. To counteract the enemy's rapid mine emplacement potential, all forces should be resourced and organized to conduct in-stride breaches during any movement.

COUNTERMOBILITY

- PROTECT FLANKS DURING OFFENSIVE OPERATIONS
- FASCAM AND CONVENTIONAL MINEFIELDS
- IT IS EASIER FOR THE THREAT TO COUNTERATTACK EXPOSED FLANKS
- PLAN FOR SITUATION OBSTACLES IN THE OFFENSE
- DEFENSIVE OPERATIONS REQUIRE INTEGRATED OBSTACLES

COUNTERMOBILITY

Plan obstacles to protect flanks during offensive operations. FASCAM and conventional minefields may be appropriate but consider time required to employ FASCAM when selecting this option. Also, when firing artillery delivered FASCAM in the desert, not only does it remove a majority of your indirect fire assets from the fight, but artillery FASCAM does not deploy properly in soft sand.

The increased mobility in the desert makes it easier for the enemy to counterattack exposed flanks of attacking forces. Situational obstacles should be planned during offensive operations to protect the flanks of the attacking force. Beyond conventionally emplaced minefields, FASCAM, which includes artillery delivered mines, GEMSS, and Air Force delivered GATOR munitions, are all systems that lend themselves to situational employment.

Defensive operations require planned obstacles to support the defensive concept with the engineers, and combat forces coordinate siting. In defensive operations, the effectiveness of obstacles is a function of synchronization. Although this is true in all areas of the world, it is especially important in the desert because the terrain allows the threat more capability to maneuver.

Disrupt, turn, fix, and block must be considered in the commander's intent when siting obstacles.

SURVIVABILITY

- DIRECT FIRE WEAPONS MORE EFFECTIVE FROM DUG-IN POSITIONS
- LOGISTICS AREAS (BSA/DSA) REQUIRE SURVIVABILITY SUPPORT WITH EMPHASIS
  - AMMUNITION DUMPS
  - FUEL DUMPS
- BULL DOZERS SHOULD BE TASKED ORGANIZED
  - PRIORITY EFFORTS
  - OPTIMUM USE
  - POSITIVE COMMAND AND CONTROL

SURVIVABILITY

With the long range observation and fields of fire in the desert, defensive positions are very vulnerable to offensive fire. This fact, coupled with a lack of natural obstacles to tie-in engineer work, may lead the commander to invest the bulk of his engineer effort into survivability positions. Survivability positions enhance the ability of all direct fire elements to survive the indirect fire preparations and return direct fire from the attacking enemy units.

Logistics areas, BSA/DSA, require additional survivability support. Desert operations require that logistics concentrations such DSAs and BSAs be given additional consideration for survivability support. These sites are large, relatively static, and difficult to camouflage. As a result, these support areas are vulnerable to enemy interdiction.

Engineer digging assets such as bulldozers should be tasked to provide survivability support to these sites with particular emphasis placed on hardening ammunition and fuel storage locations.

Be careful digging fox holes and tank hide positions, since the walls have a tendency to cave in.

AIR DEFENSE

- DISPERSION - ADDITIONAL AD ASSETS
- AD PRIORITIES - MORE SELECTIVE
- ERASE TRACKS
- COVER SHINY OBJECTS
- SMALL CONVOYS - MINIMIZE MOVEMENT
- RADAR - PROPER GROUNDS
- VULCANS - DEPLOY FORWARD IN OFFENSE

AIR DEFENSE

Adequate dispersion requires forces fighting in the desert to be reinforced with more than the normal complement of air defense weapons.

Commanders are more selective because of long lines of communication and the tendency to maneuver over relatively large areas.

Vehicle tracks leading into firing positions should be erased or covered. They are easily identified from the air.

Cover all shiny objects to eradicate glare.

Convoys should be relatively small to reduce detection by aircraft.

Air defense radar antenna performance may be degraded by as much as 1/3 if the surface soil lacks moisture for the electrical ground.

Stingers should support the forces from the high ground in their own vehicle. They are thin-skinned and could easily be destroyed if they are allowed to maneuver beyond the FEBA. In the offense, consider putting the Stinger gunner in an armored vehicle, with at least two missiles.

EMPLOYMENT OF ARMY AIRCRAFT

- ARMY AVIATION ASSETS ARE VULNERABLE TO:
  - LONG-RANGE FIRES
  - LONG-RANGE OBSERVATION
  - ACQUISITION
  - HARSH ENVIRONMENTAL CONDITIONS
- HEAT LIMITS WEAPON LOADS
- ATTACK AIRCRAFT FLYING LOW PRODUCE LARGE DUST CLOUDS

EMPLOYMENT OF ARMY AIRCRAFT

Attack aircraft flying low and slow may produce large dust clouds. These clouds of dust not only obscure aircraft acquisition systems but they are also easily detected.

These severe conditions require proper maintenance, engagement techniques, and positioning of Class III and V resources.

Extra maintenance will help correct the problems of heat, sand, and dust. Both air and ground crews must be aware that engines must be cleaned and filters changed more often during desert operations.

Firing while flying above ETL diminishes the dust signature and aids in survivability.

The loss of load capabilities is overcome by placing FARPs closer to the engagement areas.

When operating above ETL, attack aircraft can operate at higher gross weights than when hovering fire is used.

ATHHB personnel do not normally train or practice high-energy attacks and need specialized training and time to practice and rehearse these attacks.

FIELD TRAINS/BSA

RECOMMENDED DISTANCE FROM FLOT

OFFENSE 20-25 km

DEFENSE 25-30 km

TRAINS COMPOSITION

Current doctrine for employment of the trains from company to brigade level is applicable in desert operations. Doctrinal employment of trains is covered in FM 71-1, 71-2, 71-3, & FKSM 71-2-8. Doctrinal distances for trains employment from the forward line of troops (FLOT) are: brigade support area (BSA)--20 km to 25 km in the offense and 25 km to 30 km in the defense, battalion combat trains--4 km to 10 km; and company combat trains--one terrain feature or 1 km behind the company team.
company/team.

NOTE: During battle preparation, medics MUST rehearse routes from the company teams to the battalion aid stations.

BRIGADE SUPPORT AREA (BSA) MUST BE MOBILE

EVAC WOUNDED FROM BSA REARWARD

MINIMIZE GROUNDING OF SUPPLIES

BRIGADE SUPPORT AREA

To ensure the BSA can move when required, the medical company may have to reduce the length of time lightly wounded are kept or maintained at that location. Air evacuation may be required to keep the medical company mobile in the event the BSA must jump or displace quickly.

CLASS I

- PROTECT FROM WIND & DUST
- KEEP ALL CONTAINERS SEALED
- USE PLASTIC BAGS TO PROVIDE EXTRA PROTECTION
- SERVING & EATING UTENSILS MUST BE COVERED/SEALED

Class I

T-rations have decreased the problems and difficulty of feeding operations. There is a requirement for an increase of ice to keep supplement packages fresh. Supplement packs include fruit, salads, etc. After cooking utensils, serving containers, and any pots and pans have been cleaned, they will require special care to maintain sanitary conditions in the windy, dusty environment. During transport of Class I from the BSA to the forward units, items will need additional protection to avoid disease in the dusty desert.

NOTE: To keep utensils and Class I clean from disease carrying organisms, the technique of placing the items in tied trash bags will greatly assist in their protection.

CLASS III

- POL REQUIREMENTS INCREASE
- MUST GROUND FUEL VEHICLES
- EXTRA ASSETS FOR STORAGE OF POL AT BSA MAY BE REQUIRED

CLASS III

Fuel HMMETTs now fielded should be able to carry full basic loads in the desert. Additional storage of bulk fuel may be required at the BSA. The Forward Support Battalion (FSB) supply company can request additional storage bladders. The amount of fuel required at the combat trains will be dependent upon METT-T. Static electricity increases in the desert operation. Fuel hoses and couplings must be checked daily for serviceability.

NOTE: Fuel vehicles MUST BE GROUNDED during refueling and while in stationary positions.

CLASS V

- KEEP AMMO OUT OF DIRECT SUN LIGHT
- AMMO HANDLING TIME WILL INCREASE W/ INCREASE IN TEMP

CLASS V

Current equipment fielded at battalion task force level should be capable of transporting the required Class V from the ammunition transfer point (ATP located at the BSA to the forward elements. The amount of Class V that will be required at the battalion combat trains will be governed by METT-T. Ammunition should not be in direct sunlight. Use camouflage nets and tarpaulins to provide shade for Class V.

NOTE: Increased heat will require additional time for handling ammunition.

WATER

- CAN'T DRINK TOO MUCH
- LEADERS CHECK WATER... ENSURE COOL & POTABLE
- KEEP CLOTHES ON - USE LESS WATER
- 9 QUARTS PER DAY TO SURVIVE ...5 GALLONS PLUS RECOMMENDED
- ACCLIMATED SOLDIERS USE SAME AMOUNT OF WATER

Water:

Maintaining safe, clean, water supplies is critical. The best containers for small quantities of water (5 gallons) is plastic water cans or coolers. Water in plastic cans will be good up to 72 hours, metal is only good for 24 hours. Canteen water should be changed every 24 hours. Water in trailers, if kept cool, will last up to five days. If the air temperature exceeds 100 degrees Fahrenheit, the water temperature must be monitored. When it exceeds 92 degrees, it should be changed, as bacteria will multiply and if not changed will cause sickness and diarrhea. Ice in containers will keep water cool. If Ice is put in trailers, the ice must be removed before movement. Failure to remove the ice will cause damage and destroy the inner lining of the trailer.

NOTE: Issued water containers must be carried for drinking water only.

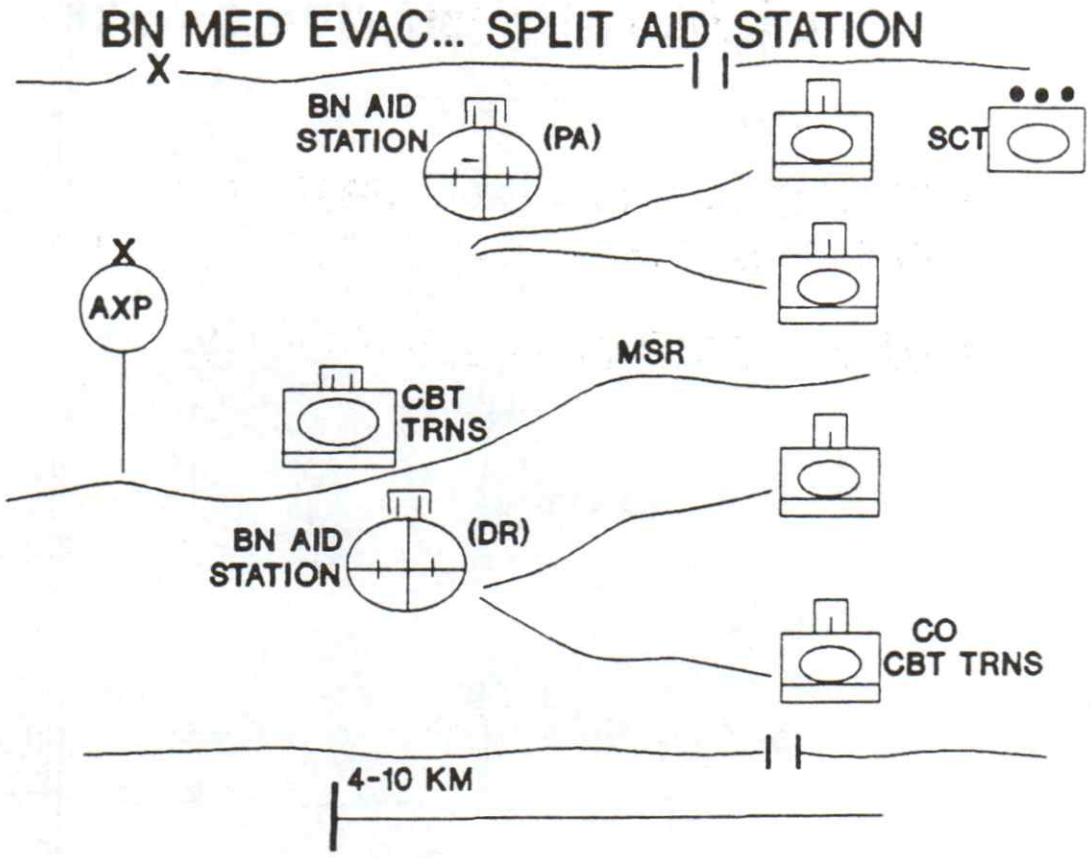
HEALTH SERVICES

- PERSONAL HYGIENE IMPERATIVE FOR HEALTH & FORCE SUSTAINMENT
- MUST EMPHASIZE SANITATION

HEALTH SERVICES

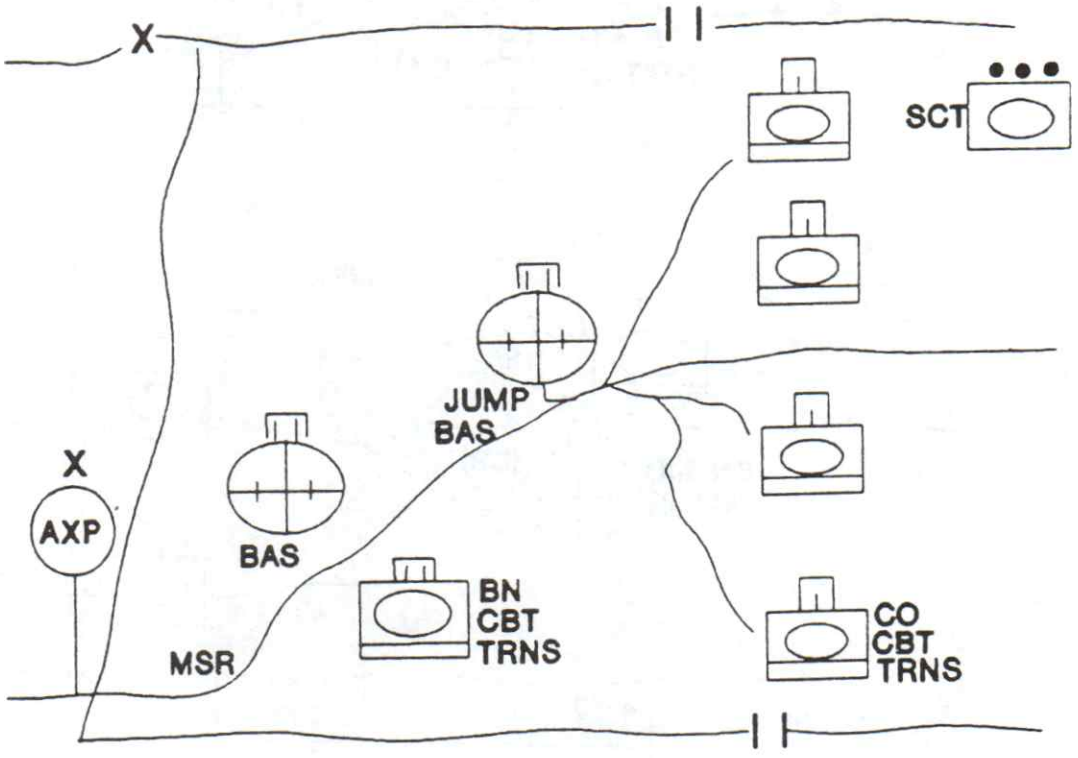
Heat injuries normally increase in the desert. Depending upon the severity of the heat injury, an I V may be started. Extreme care should be taken to ensure the IV solution is not allowed to get hot. This is of particular concern to combat life savers. Emphasis must be placed on sanitation. Poor personal hygiene and lack of attention to designated locations for latrines can cause more casualties than actual combat. Field Marshal Rommel lost over 28,400 soldiers to disease in 1942. In the desert for every 1 combat injury, there were 3 hospitalized for disease.

NOTE: Emphasis MUST be placed on sanitation concerns.



Other than the standard employment of a consolidated Battalion Aid Station (BAS) at the Combat Trains, there are two basic techniques for the BAS in support of a Battalion Task Force. This is the technique refered to as the Split Aid Stations. Typically, the 'Split BAS' is used in support of a dispersed defense, providing a more respondant and possibly faster triage and stablization of the wounded.

BN AID STATION (BAS) JUMP BAS TECHNIQUE



The second technique is referred to as jump aid stations. Typically, the "Jump BAS" technique is used in the offense. This technique is used just as a "Jump TOC" for a battalion command to maintain operation and support for the battalion task force.

DESERT COMMUNICATIONS
GENERAL CONSIDERATIONS

- RADIO IS PRIMARY COMMO MEANS
- LIMITED RANGE DUE TO POOR ELECTRICAL GROUND

GENERAL CONSIDERATIONS

Radio is usually the primary means of communications in the desert. It can be employed effectively in desert climate and terrain to provide the highly mobile means of communications demanded by widely dispersed forces. However, desert terrain provides poor electrical ground and a counterpoise (an artificial ground) is needed to improve the range of certain antennas.

DESERT COMMUNICATIONS
TECHNIQUES FOR BETTER OPERATIONS

- LOCATE ANTENNAS ON HIGH TERRAIN
- GROUNDING TECHNIQUES
- COUNTERPOISE TECHNIQUES
- COOLING AND CLEANING THE EQUIPMENT

TECHNIQUES FOR DESERT OPERATION

a. For the best operation in the desert, radio antennas should be located on the highest terrain.

b. Grounding techniques:

(1) In FM communications, ensure that the radio and antenna are metal to metal, grounded to the body of the vehicle.

(2) In AM communications, ensure that the radio and antenna are connected by means of a grounding strap and stake to earth ground.

(3) In the absence of a grounding stake, use one or more metal rods or poles driven into the earth. A good ground can also be achieved by connecting to metal structures or underground pipe systems. Ensure that the connecting points have been scraped clean of any paint or corrosion. Cover the connecting point with tape to prevent resistance due to oxidation of the metal.

(4) Add a salt water solution to the soil at the grounding stake.

(5) Urinate on the ground around and close to the grounding stake.

c. Counterpoise techniques:

(1) For mounted FM radio systems, the vehicle is the counterpoise. You can increase your transmission range by pointing the diagonally opposite end of the vehicle, from the antenna, toward the intended reception station.

(2) If a field expedient Vertical Half-Rhombic antenna is made from field wire, you must run a wire the full length of the antenna, slightly above the ground and insulated from the ground, to function as a counterpoise.

d. Cooling and cleaning the equipment:

(1) Radios, regardless of type, must be kept cool and clean. They must be in shade whenever possible and should be located in a ventilated area. Exposed equipment should be protected with a canvas cover or some other material, which will shield it from the sun's rays while permitting the circulation of air.

(2) In dusty environments, daily cleaning of the radio air vents may be required. Daily cleaning of all connectors will insure proper electrical contact of all components. Protect all connections from condensation by wiping them clean and then wrapping them with electrical tape. Dust covers should be used whenever possible. Some receiver-transmitter units have ventilating ports and channels that can get clogged with dust.

(3) During periods of extremely high temperatures, damp towels may be placed on top of the radio to aid in cooling. Insure that vents are not blocked. Equipment power should be left on only when absolutely necessary. Radios should be kept on low power for short-range communications. They should be turned to high power only for long-range communications. Minimizing the duration of transmissions is also important. Using the short burst technique not only improves communications security, but also reduces the power load on the radios. As a result, overheating and maintenance problems are further reduced. Some radios automatically switch on their blower fan if their internal temperature rises too high. This may disturb soldiers unaccustomed to radio operation in the desert environment. Operation of the fan, however, is quite normal.

DESERT COMMUNICATIONS

- EQUIPMENT CONSIDERATIONS
  - BATTERIES
  - ELECTRICAL INSULATION
  - STATIC ELECTRICITY
  - DESERT PMCS
- OTHER CONSIDERATIONS
  - MSE

EQUIPMENT CONSIDERATIONS

a. Batteries: Wet cell batteries do not hold their charge efficiently in intense heat. Electrolyte evaporates rapidly and should be checked weekly (more often, if warranted). Add distilled water as needed. Extra containers of distilled water should be carried in the vehicle. Maintenance of vehicle batteries beyond adding water must be done only by authorized motor pool personnel according to applicable regulations. Dry battery supplies must be increased, since hot weather causes batteries to fail more rapidly.

b. Electrical Insulation: Wind-blown sand and grit will damage electrical wire insulation over a period of time. All cables that are likely to be damaged should be protected with tape before insulation becomes worn.

c. Static Electricity: Static electricity is prevalent in the desert. It is caused by many factors, one of which is wind-blown dust particles. Extremely low humidity contributes highly to static discharges between charged particles. Poor grounding conditions aggravate the problem. Be sure to tape all sharp edges (tips) of antennas to cut down on wind-caused static discharges and the accompanying noise. If you are operating from a fixed position, ensure that equipment is properly grounded. Since static-caused noise diminishes with an increase in frequency, use the highest frequencies that are available and authorized.

d. Desert PMCS: In desert areas, the maintenance of radio sets becomes more difficult because of the large amounts of sand, dust, or dirt that enter the equipment. Sets equipped with servomechanisms are particularly affected. To reduce maintenance downtime, keep the sets in dustproof containers as much as possible. It is also important to keep air vent filters clean to allow cool air to circulate to prevent overheating. Preventive maintenance checks should be made frequently. Also, you should keep a close check on lubricated parts of the equipment. If dust and dirt mix with the lubricants, moving parts may be damaged.

4. OTHER CONSIDERATIONS: Mobile Subscriber Equipment (MSE)

It may be necessary to deploy additional Radio Access Units (RAU) AN/TRC-191. These assemblages are the primary link for the Mobile Subscriber Radio Telephone Terminal (MSRT) AN/VRC-97 which will be located down to battalion level. The nominal operating range of the receiver-transmitters used with these radios may be only 10 kilometers in the desert.

OFFENSIVE OPERATIONS

- COMMANDER HAS TO ADJUST HIS CONCEPT OF SPACE
- INFANTRY IN THE ATTACK REMAIN MOUNTED UNTIL THE VERY LAST MINUTE
- UNITS WILL HAVE VULNERABLE FLANKS
- RELY ON BATTLE PLAYS AND DRILLS
- EMPLOY RECON ASSETS FARTHER FORWARD
- USE GAPS AND WADIS TO INFILTRATE ENEMY REAR

OFFENSIVE OPERATIONS

Offensive operations in the desert follow the same rules as used in any offensive operation with certain factors of METT-T stressed more than others.

- o CONCEPT OF SPACE. Due to long range observation and fires, spacing between vehicles and formations must be increased for survivability. Likewise units have a capability to mass fires at greater distances from more disperesed positions.
- o REMAIN MOUNTED. Due to sparse cover and concealment.
- o VULNERABLE FLANKS. Use 'recon pull' to attack the enemy in his flank, while screening your own movement.
- o BATTLE DRILLS. Due to the rapidity of movement.

Provide for mutual support of several units to one another to increase protection from being flanked or overrun. Position forces to flanks of avenues of approach rather than on one approach.

OFFENSIVE OPERATIONS
(CONT)

- USE MORE CONTROL MEASURES TO PREVENT FRATRICIDE:
  - CHOOSE TERRAIN FEATURES EASILY IDENTIFIABLE WITH THERMAL OR PASSIVE NVDS
  - EMPLOY PYROTECHNICS OR AUDIO SIGNALS
  - EMPHASIZE IFF PROCEDURES
  - USE TIGHTER FORMATIONS
  - MANEUVER IN COLUMN AS LONG AS POSSIBLE
  - PLAN ON USING MUCH MORE SMOKE THAN USUAL
  - ESTABLISH WELL IDENTIFIED RALLY POINTS
- RAIDS AND SPOILING ATTACKS HAVE HIGH CHANCE OF SUCCESS
- LOW VISIBILITY OPERATIONS

OFFENSIVE OPERATIONS (CONT)

Large expanses of relatively open terrain and potentially poor visibility all require greater command and control and physical control measures.

Attempt to structure the fight to engage enemy units which are moving. Take advantage of superior shoot-on-the-move and fire control capability. A meeting engagement is better than attacking a fortified position. Plan and rehearse use of reserve for decisive operations.

- o LOW VISIBILITY. Smoke, dust, sand, haze, mirages all contribute to hindering visibility and require special attention.

OFFENSIVE OPERATIONS
ESSENTIAL PRINCIPLES

- MAXIMUM RECON FORCE FORWARD
- ORIENT ON LOCATION OR MOVEMENT OF OBJECTIVE
- REPORT ALL INFORMATION RAPIDLY AND ACCURATELY
- RETAIN FREEDOM TO MANEUVER
- GAIN AND MAINTAIN ENEMY CONTACT

OFFENSIVE OPERATIONS ESSENTIAL PRINCIPLES

- MAXIMUM RECON FORWARD. Employ all recon assets forward, but plan for rotation of recon assets during extended recon operations. Scouts should be performing reconnaissance or sleeping.
- ORIENT ON OBJECTIVE. Focus the direction on an enemy force or terrain feature.
- REPORT INFORMATION. Providing raw combat information quickly to the higher unit commander and staff is the most important result of reconnaissance.
- FREEDOM TO MANEUVER. Avoid decisive engagement by using secure movement techniques.
- GAIN ENEMY CONTACT. Track enemy movements and activities continuously.

OFFENSIVE OPERATIONS
ESSENTIAL PRINCIPLES (CONT)

- DEVELOP THE SITUATION RAPIDLY
- CONTINUITY
- AGGRESSIVENESS
- TIMELINESS

OFFENSIVE OPERATIONS ESSENTIAL PRINCIPLES (CONT)

- o DEVELOP THE SITUATION. Obtain enough information about enemy elements to determine size, composition, disposition, activities, and future intentions. Recon by stealth, observation, or fire to gain the information.
- o CONTINUITY. Employ a wide variety of assets with overlapping coverage to maintain contact with the enemy at all times.
- o AGGRESSIVENESS. Fight (attack, sabotage, raid, ambush) to gain information. Stress the need for initiative, resourcefulness, and daring in the conduct of reconnaissance and any following combat operation.
- o TIMELINESS. Employ increased automation for troop control and processing of information, obtain near real-time aerial downlinks, and in the future, satellite downlink.

OFFENSIVE OPERATIONS
ESSENTIAL PRINCIPLES (CONT)

- ACCURACY AND RELIABILITY
- APPROACH
- MOVEMENT TECHNIQUES
- SURPRISE

OFFENSIVE OPERATIONS ESSENTIAL PRINCIPLES (CONT)

- o ACCURACY AND RELIABILITY. Attempt to verify information from more than one reconnaissance source. Overlapping reconnaissance coverage and improved technology aid this effort.
- o APPROACH. In the execution of an offensive mission, particularly one commenced just prior to daylight, stealth and the clever use of covered approaches are as important as supporting or prepatory fire.
- o MOVEMENT TECHNIQUES. When exposed vehicular movement is necessary under fire, supporting weapons must cover this movement with stationary fire. Speed is everything. The enemy must never be allowed time to reorganize.
- o SURPRISE. The tactical surprise gained by attacking an adversary in an unexpected manner is a significant combat multiplier that can enable the attacker to defeat a numerically superior enemy.

LESSONS LEARNED
DESERT OFFENSIVE OPERATIONS

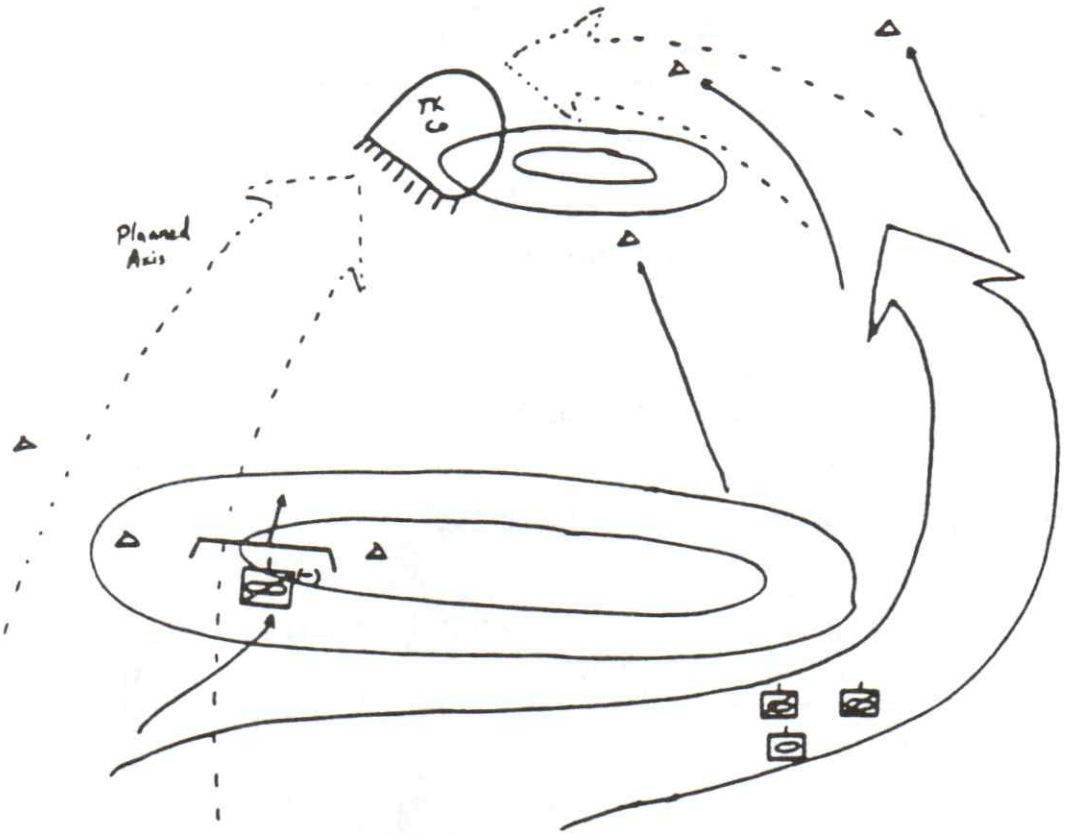
- FIRE SUPPORT
  - -Smoke is more effective during early hours and in low-lying areas.
  - -Use VT against moving forces.
  - -Use illumination to keep task forces oriented. Use it during day and night operations.
- RECONNAISSANCE
  - -Importance can't be overemphasized.
- MOVEMENT TECHNIQUES
  - -Have constant maneuver that avoids being slowed by improper movement techniques.
  - -Avoid dissipating the unit's mass through separate engagements.

LESSONS LEARNED
DESERT OFFENSIVE OPERATIONS

The formation of the mountain ranges against the sky at night is extremely helpful in maintaining a sense of direction and orientation for calling for and adjusting fire. Familiarize yourself with the mountain ranges. Accurately locating the enemy has to be a high priority. Survey-in the FIST-Vs very early. Also use the FIST-Vs to accurately locate TRFs, trigger points, and obstacles. Enemy targets can be identified from great distances by many observers. Ensure that you assign FOs, FISTs, and COLTs areas of responsibility in order to prevent all of them from engaging the same target at the same time.

There is typically a battle which precedes the battle--a confrontation of opposing reconnaissance units--and the winner of that preliminary battle is often the victor in the desert.

If a unit's combat power is not deployed against the enemy faster than he can react, then the attack is too slow. Use tight, agile combined arms formations capable of rapid, controlled movement. Commit successive units without gaps that can be exploited by the enemy. Avoid piecemeal engagements against small pockets of resistance--suppress and bypass. Mass artillery fires to destroy or degrade enemy direct-fire weapons during the assault phases. Smoke is a major factor in desert warfare. Use it in the attack. In the defense, be prepared to move to alternate positions when the enemy uses smoke to obscure your fields of fire.



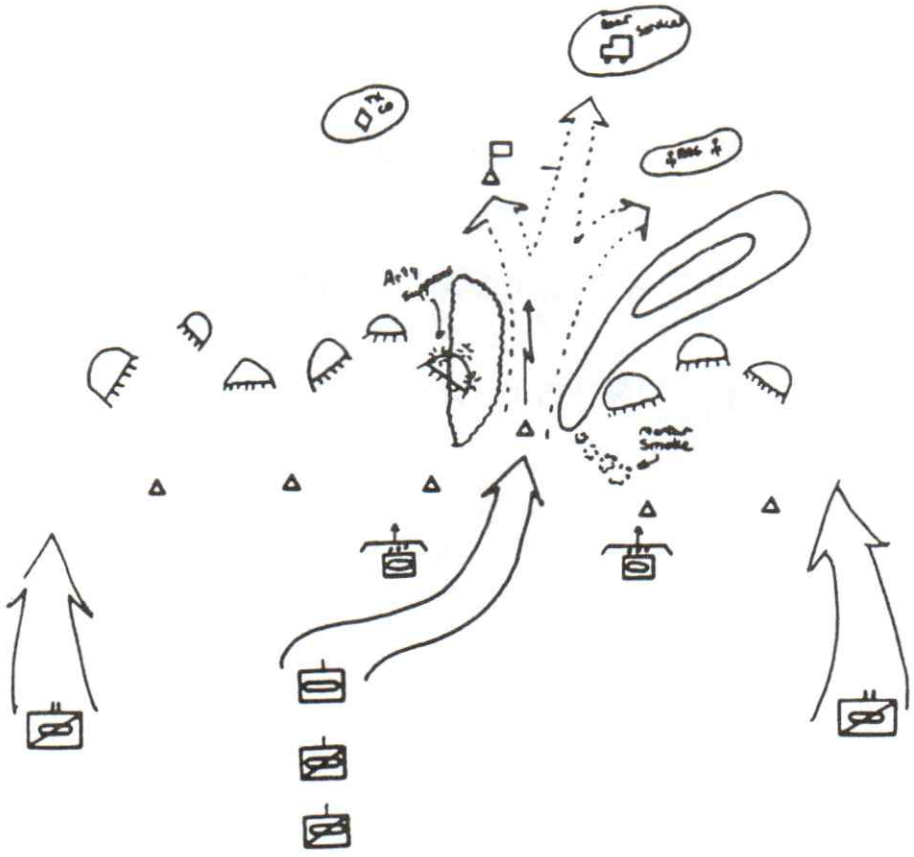
RECON PULL

GENERAL. Recon pull is a technique used by commanders to identify and maneuver against an enemy weak point and to exploit success. Leaders at every level — from scout squad leader to RCO — may use this technique. In a force-oriented attack, the commander should maneuver his main effort against the enemy weak point. By attacking the weak point of the enemy, the commander enhances the ability of the unit to destroy the enemy because it can generate tremendous local superiority in firepower.

Commanders normally identify a weak point during IPB. Often, however, the commander will not know ahead of time the exact location of the weak point with absolute certainty. Reconnaissance during the execution of the attack will often disclose that the suspected weak point is not present, and that there is a weak point elsewhere. The commander should then attempt to shift his main effort to attack the newly discovered weak point.

RECON PULL TO A FLANK (EXAMPLE)

Scouts observed an enemy tank company in a battle position oriented on the initial axis of attack. After developing the situation, the scouts identified that the enemy had no tanks oriented toward his left flank. The squadron commander maneuvered to assault the enemy from his flank.



RECON PULL
THROUGH AN UNOBSERVED GAP (EXAMPLE)

The purpose of the squadron mission is to assist the ACR in destroying a depleted enemy tank regiment which has hastily occupied a defensive position in contact. The lead troop of the squadron identifies a gap between enemy company positions. The squadron commander provides overwatch with one troop and moves the tank company and the other two troops through the gap into the enemy rear. Once into the second echelon of the enemy, they locate and destroy the remnants of the RAG, command and control facilities, and rear services. The other squadrons of the ACR then complete the destruction of the regiment by attacking the first echelon battalions (-).

DEFENSIVE OPERATIONS

- MAINTAIN SMALL NUMBERS OF FORCES FORWARD
- MAINTAIN A LARGE MANEUVER RESERVE
- RETENTION OF TERRAIN NORMALLY MAKES LITTLE DIFFERENCE
- DESTRUCTION OF ENEMY FORCES IS THE PRIMARY FOCUS

LESSONS LEARNED
DESERT DEFENSIVE OPERATIONS

In defensive operations, the retention of ground becomes less important than the retention of the initiative. Unlike other theaters of operations, the unlimited maneuver space provided by most deserts makes defensive operations more maneuver oriented. The desert fight cannot be won with a static defensive orientation. The commander must exploit his reconnaissance assets to determine the intent of the enemy force and use a large, mobile reserve to maneuver and destroy the enemy.

OBSERVATION TECHNIQUES

- USE GSRs TO AID NAVIGATION
- PLAN FOR BUT DO NOT USE ILLUMINATION UNLESS TO HIGHLIGHT ENEMY LOCATIONS
- USE AIRMOBILE INSERTIONS FOR RECON
- USE ARTILLERY TO AID NAVIGATION

OBSERVATION TECHNIQUES

Use GSRs to aid navigation by 'overwatching' scouts and tanks to check their grid coordinates, direction of movement.

Use illumination to highlight the enemy location during an offensive movement.

Use airmobile insertions for reconnaissance, OPs.

Tanks must closely coordinate with scouts for IFF, review or rehearse thermal signatures of friendly scout vehicles.

Narrow zones.

Use artillery to aid navigation.

Use smoke to obscure enemy IR sights.

Scout sections must move laterally more often to cover platoon zone.

HVY/LT FORCE INTEGRATION
OFFENSE

- RAPID MOVEMENT OF LIGHT FORCES EITHER TO RAID OR ESTABLISH BLOCKING POSITIONS IN THE ENEMY'S REAR IS A GREAT ADVANTAGE
- WHEN A LT INFANTRY FORCE IS PLACED ON THE GROUND, RESUPPLY IS QUICKLY EXHAUSTED
- TO ESTABLISH A BLOCKING POSITION

HVY/LT FORCES INTEGRATION

OFFENSE

In the desert, rapid movement of light forces requires the dedicated use of aviation transport assets and requires extensive preparation and planning. When infantry assets are used in this role they must be inserted quickly and with stealth. Surprise is the key to effectiveness in these operations.

Plan for rapid reinforcement and resupply of light forces after vertical insertion.

Blocking positions must be favorable to an all-around defense. The location must also allow quick occupation of hard cover to protect against enemy artillery fires.

HVY/LT FORCE INTEGRATION
DEFENSE CONSIDERATIONS

- ADDITIONAL COMMUNICATIONS EQUIPMENT WITH THE LONGEST RANGE POSSIBLE SHOULD BE INCLUDED IN THE POSITION
- DEFENSIVE PLAN MUST INCLUDE PREPARATIONS TO FIGHT AFTER ENCIRCLEMENT
- THE PLAN SHOULD ADDRESS ESCAPE AND EVASION PROVISIONS
- LASER DESIGNATOR SYSTEMS AND TACFIRE EQUIPMENT SHOULD REINFORCE THE POSITION

HVY/LT FORCE INTEGRATION
DEFENSE CONSIDERATIONS

Additional long range communications equipment allows the defense to provide deep reconnaissance information for close air support or artillery targeting. The equipment also provides the communication assets for air resupply or extraction.

The plan for fighting after encirclement should provide for extensive supplies of materials to build defensive positions. Examples:

- o Chicken wire for making bundles of rocks.
- o Lumber or tin sheets for creating overhead cover.
- o Large numbers of sandbags, or even trash bags filled with sand, for preparing fighting positions.

Escape and evasion provisions should be part of every defensive plan.

Laser designator systems and TACFIRE equipment allow defensive positions access to other, nonorganic defensive fires and weapons.

HVY/LT FORCE INTEGRATION
DEFENSE

- NON-MECH INF HAVE GREATEST VALUE IN PREPARED POSITIONS
- POSITIONS MUST BE CHOSEN TO PROVIDE 360-DEGREE DEFENSE AND HEAVY DEFENSIVE COVER
- REVERSE SLOPE DEFENSES ARE FAVORED
- LT FORCES REQUIRE A LARGER PROPORTION OF THE ENGINEER SUPPORT

HVY/LT FORCE INTEGRATION
DEFENSE

Because of the threat's use of armored and mechanized forces and the desert's lack of natural cover and concealment, nonmechanized infantry are most valuable in the defense when they fight from prepared positions.

These positions must provide for a 360 degree defense because high-mobility threat forces may attack from any direction. Threat use of artillery fires in preparation and in support of the attack mandate heavy overhead cover for defending infantry.

Reverse slope defenses for dismounted infantry are necessitated by their lack of battlefield mobility and the fact that their primary weapon systems are outranged by the primary weapon systems of a threat mechanized force.

In order to complete effective and survivable defensive positions quickly, light forces require a larger proportion of the available engineer support.

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